

CHAPTER 4

IN-PLANT FISH ASSESSMENT

2007

INTRODUCTION

This chapter reports on fish impingement at the San Onofre Nuclear Generating Station (SONGS) in compliance with National Pollutant Discharge Elimination System (NPDES) requirements. The term "impingement" refers to entrapped fish that are killed in the SONGS cooling system and are removed by traveling screens. This chapter summarizes in-plant fish collection data for the year 2007 at San Onofre Units 2 and 3. San Onofre Unit 1 was taken out of service in 1992 and did not operate in 2007. Its NPDES permit has been rescinded and the Unit is not considered in this report.

Fish enter Units 2 and 3 of the station via seawater intakes supplying cooling water to the station. Most of the fish are guided through the intake screenwell to the fish return system and are returned to the ocean alive. Those remaining are impinged on the traveling screens and are deposited in containers for disposal. Estimates of the total number and weight of fish impinged during normal plant operation, including heat treatment, and analysis of size (age) and sex composition of select impinged species are presented in this report for Units 2 and 3 at SONGS.

Included in this chapter is a report on the operation and effectiveness of "Fish Chase" procedures carried out in 2007 as a means of increasing fish survival at SONGS. The "Fish Chase" is a procedure used at SONGS to remove as many fish as possible from the circulating water system before heat treatment procedures are conducted. Heat treatment procedures are necessary to eliminate fouling organisms from colonizing within the cooling water system¹.

This report also includes a summary of Fish Return System (FRS) data collected in 2007 as part of a study to develop data for compliance with Section 316(b) of the Clean Water Act. The study spanned a period from March 2006 to May 2007. Only the 2007 data are included in this report.

METHODS

The analytical approach for this section utilizes tabular summaries of the number of individuals and biomass of fish impinged during normal operations and heat treatments. The total annual normal operation catch is calculated by multiplying the total number and weight of fish sampled during 24-hour sample periods by the total amount of sea water pumped during each month of the year divided by the amount of water sampled during the 24-hour samples. Fish collected during

¹ Information in this report regarding the Fish Chase procedure also meets requirements of Condition B of the Coastal Development Permit for SONGS (permit no. 6-81-330-A, formerly 183-73 issued by the California Coastal Commission.

heat treatments are added to the total for the month during which they occurred. The months, January through December, are summed to give the annual total for each unit.

In 1999, a new NPDES permit was issued to the San Onofre Nuclear Generating Station that reduced the requirement for fish impingement monitoring from monthly sampling to quarterly sampling. This change went into effect in August 1999. However, a special one-year study of fish impingement for requirements of Section 316(b) of the Clean Water Act² temporarily increased sampling frequency to bi-weekly beginning in March 2006 and ending in April 2007. For this reason, in 2007 normal operation samples were taken approximately twice per month from January through April at Unit 2 and January through May at Unit 3. Monthly impingement was estimated using any samples falling within the calendar month. Unsampled months resulting from a quarterly sampling schedule in the third and fourth quarters of 2007, or periods of interrupted flow such as during maintenance, utilized data extrapolated from adjacent months. Heat treatment fish loss was added to the months during which the heat treatments occurred. A list of all samples is provided in Appendix A.

Length-frequency distributions of select species impinged in 2007 are constructed using samples of a maximum of 125 individuals for each normal operation and heat treatment sample. Fish were measured to the nearest millimeter. Sex ratios are estimated based on sub-samples of a maximum of 50 individuals per sample.

HEAT TREATMENT SAMPLES

Heat treatments at San Onofre involve recirculating approximately two-thirds of the normal discharge flow back through the condenser to achieve a temperature of 105°F (41°C) in the screenwell to control the growth of fouling organisms, especially mussels and barnacles. The intake conduit is heat treated in this manner on an as-required schedule based upon a biofouling growth model (LCMR 1977) and operational requirements of the plant. During the heat treatment process, fish residing in the screenwell die due to the elevated temperatures. The dead fish are removed by screens and collected by biologists who separate them by species. They are then counted, weighed, and sub-samples are processed for length and sex determination.

FISH CHASE

A "fish chase" procedure has been developed at SONGS to reduce the impact on fish populations by minimizing the number of fish killed during heat treatments. The fish chase is a procedure unique to SONGS. It was developed to allow live fish to move out of the circulating water system before beginning the heat treatment. Many of these fish accumulate in the cooling water system between heat treatments, often residing in habitat provided by gate slots and other structures within the system. The fish chase is accomplished by slowly manipulating cross-over gates in the vicinity of the screenwell, where most of the fish reside. This operation re-circulates effluent water so that the water is slowly warmed. The gate manipulations also create eddy currents that will dislodge fish that have congregated in areas of low flow. The elevated temperatures and new

² Federal Register, July 9, 2004, Vol. 69, No. 131. Environmental Protection Agency, 40 CFR Parts 9, 122, 123, 124 and 125.

flow patterns are intended to agitate fish enough that they will seek new habitat and will find their way into the fish return elevator for release back to the ocean. Without the fish chase procedure, all fish residing in the circulating water system at the time of the heat treatment likely would be killed. The fish chase is monitored by biologists to assure that the fish are not overly stressed by the procedure. Engineers, operators and biologists are continuing to improve on the effectiveness of the fish chase by experimenting with various combinations of temperature and gate changes and the length of the fish chase.

NORMAL OPERATION

Normal plant operation samples of fish are collected according to the frequency required by the station's NPDES permit, except during periods when the units are not in service due to refueling or maintenance. These 24-hour samples are intended to be representative of the amount of fish that enter the plant during a "normal" day's operation. In 2007, samples were taken bi-weekly from January through April 3, at Unit 2, and January to May 15 at Unit 3. These bi-weekly samples were part of a special 316(b) study. From the end of the 316(b) study through December 2007, estimates of normal operation impingement were based on quarterly samples, as required by the Stations NPDES permit. Overall, there were eight 24-hour³ normal operation samples at Unit 2 and fifteen at Unit 3 in 2007.

FISH RETURN SYSTEM (FRS)

At Units 2 and 3, fish are guided via vanes and louvers to the fish return chamber where an elevator raises them to the surface of the intake screenwell and releases them via a sluiceway back to the ocean. Previously reported studies (SCE, 1988; Love, *et al*, 1989) assessed the effectiveness and survivorship of the fish return system. In 1999, additional studies of the fish return system were conducted as part of a special study for the California Coastal Commission. In 2006 and 2007 the efficiency of the FRS was once again examined as a part of the 316(b) study program. Samples were taken approximately bi-weekly, concurrent with normal operation samples.

The fish return system is operated by equipment operators at least twice daily and operations are logged on daily status sheets (Form SO123-0-10) (M. J. Johnson, Personal Communications).

DATA ANALYSIS

Analysis of impingement catch involves (1) estimating the catch of all fish species occurring during the year, (2) describing the length-frequency distributions of commonly occurring species, and (3) describing sex ratios of commonly occurring species. All weight, count, length measurement and gender determination data are provided in the 2007 Annual Data Report. This chapter of the Analysis Report presents catch data for the 15 most common species and length and sex data for species believed to be of particular interest to resource managers, assuming sufficient data exists for meaningful analysis.

³ Some 24-hour samples were divided into two 12-hour samples to provide diel information on fish impingement and entrainment.

The calculation used to determine the annual impingement catch in weight and numbers of fish during normal operation and heat treatment was described earlier in this section.

The number of fish released during the fish chase procedures are estimated by visual counts from biologists as the fish are raised in the fish return elevator. Fish are not netted or captured for processing since this would negate the benefit of the procedure. Biomass is determined by applying the values measured for fish of the same species taken in the subsequent heat treatment samples. That is, fish returned via the fish return system are assumed, on average, to weigh the same as fish taken in the following heat treatment. This results in a conservative estimate of biomass since returned fish tend to be larger than impinged fish.

Size structure and sex ratios of select species are examined using length-frequency histograms and sex ratio tables developed from data gathered during impingement sampling.

RESULTS AND DISCUSSION

SUMMARY OF PLANT OPERATIONS

The monthly operational status of each unit in 2007 is summarized in Table 4-1. The table shows the number of gallons of seawater pumped per month. The amount of power produced at the station is not necessarily related to the volume of seawater pumped. This is because circulating water pumps may have to be operated even when the station is not producing power and the pumps operate at only one speed whereas the plant may not always be run at maximum capacity.

Table 4-1. Monthly Circulating Water Flow in 2007.

Month	Unit 2 10 ⁶ gallons	Unit 3 10 ⁶ gallons
January	37,776	37,191
February	34,120	34,120
March	37,776	37,776
April	36,558	36,558
May	37,776	37,776
June	36,558	36,558
July	37,776	37,776
August	37,776	37,776
September	36,558	36,558
October	37,776	35,631
November	36,558	36,558
December	1,433	37,776
Total	408,441	442,054

ANNUAL IMPINGEMENT ESTIMATE

Unit 1

Unit 1 is no longer in service.

Unit 2

The 2007 annual impingement estimate for Unit 2 is based on eleven 24-hour "normal operation" impingement samples and eight heat treatment samples conducted during the year. Appendix A lists all normal operation and heat treatment samples collected at Unit 2 in 2007, as well as fish chase and fish return system samples. Table 4-2 shows the estimated monthly abundance of the 15 most abundant fish species and all species combined in 2007. Table 4-3 presents the estimated monthly biomass of the top 15 fish species by weight in kilograms. A list of all normal operation, heat treatment, fish chase and fish return samples taken in 2007 are presented in Appendices A-1 (Unit 2) and A-2 (Unit 3). Monthly abundance and biomass of all species occurring at SONGS Unit 2 in 2007 are presented in detail in Appendices B and C, respectively.

A total of 69 species of fish were counted and weighed at Unit 2 in 2007. When weighted by the total amount of seawater used by Unit 2 in 2007, the estimated fish impingement was 379,436 individuals weighing 6,175.43 kilograms. The top 15 species accounted for 99.02% of the total number and 96.95% of the total weight. Queenfish were the most numerous species contributing 81.36% of the total number. Queenfish also contributed the greatest weight with 25.25% of the total. Northern anchovy ranked second in numbers of individuals with 7.22% while yellowfin croaker contributed the second most weight, with 25.18% of the total biomass.

Unit 3

The 2007 annual impingement estimate for Unit 3 is based on fifteen 24-hour "normal operation" impingement samples and twelve heat treatment samples conducted during the year. Table 4-4 shows the estimated monthly abundance of the 15 most abundant fish species and all species combined in 2007. Table 4-5 presents the estimated monthly biomass of the top 15 fish species by weight in kilograms. Monthly abundance and biomass of all species occurring at SONGS Unit 3 in 2007 are presented in detail in Appendices D and E, respectively.

A total of 72 species of fish were counted and weighed at Unit 3 in 2007. When weighted by the total amount of seawater used by Unit 3 in 2007, the estimated fish impingement was 300,736 individuals weighing 4,894.06 kilograms. The top 15 species accounted for 97.45% of the total number and 94.33% of the total weight. Queenfish were the most numerous species contributing 77.82% of the total number of fish. Queenfish also contributed the greatest weight with 43.34% of the total biomass.

Table 4-2. Estimated Monthly Count of Fish Impinged at Unit 2 in 2007

Common Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	% of Total
queenfish	640	15526	2883	17276	18450	17155	44578	45462	45280	50220	49351	1905	308726	81.36%
northern anchovy	1181	3262	403	1164	1191	1145	186	1022	201	8649	8669	328	27401	7.22%
jacksmelt	55	28	0	2873	2936	2767	0	3	1	0	3	0	8666	2.28%
salema	248	196	1240	1679	2952	171	186	368	203	434	570	16	8263	2.18%
deep body anchovy	23	1260	62	0	0	0	0	0	0	2263	2323	86	6042	1.59%
yellowfin croaker	2	42	0	2	6	31	62	4086	62	31	50	1	4375	1.15%
kelp pipefish	372	924	1612	273	282	270	0	0	0	310	302	12	4357	1.15%
Pacific sardine	113	56	1085	61	90	61	0	28	0	62	75	2	1633	0.43%
shiner perch	2	0	31	66	216	34	155	407	151	0	2	0	1064	0.28%
sargo	22	0	0	0	1	32	0	894	55	0	40	0	1044	0.28%
slough anchovy	0	868	93	0	0	0	0	0	0	0	0	0	961	0.25%
white croaker	102	0	31	4	68	0	124	208	154	124	127	5	947	0.25%
rockpool blenny	110	14	0	149	124	37	0	2	129	31	339	1	936	0.25%
topsmelt	22	0	0	60	71	139	124	164	126	0	2	0	708	0.19%
jack mackerel	0	0	0	5	314	14	0	75	0	62	120	2	592	0.16%
Total of top 15 species	2888	22176	7440	23612	26701	21856	45415	52719	46388	62186	61973	2359	375713	99.02%
Total of all 69 species	3467	22386	7471	23983	27394	22200	45663	53128	46689	62372	62317	2366	379436	100.00%

Table 4-3. Estimated Monthly Weight (Kgs) of Fish Impinged at Unit 2 in 2007

Common Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	% of Total
queenfish	2.874	83.202	18.507	156.116	182.959	161.424	178.250	204.692	189.755	186.434	188.034	7.073	1559.320	25.25%
yellowfin croaker	0.240	0.000	0.000	0.275	0.705	7.300	20.770	1501.210	20.270	1.612	2.754	0.061	1555.197	25.18%
California electric ray	201.900	140.000	0.000	321.000	331.700	321.000	0.000	0.000	0.000	0.000	0.000	0.000	1315.600	21.30%
jacksmelt	5.689	1.876	0.000	230.266	236.586	222.368	0.000	0.022	0.017	0.000	0.624	0.000	697.448	11.29%
sargo	3.958	0.000	0.000	0.000	0.086	9.600	0.000	168.288	9.806	0.000	4.085	0.000	195.823	3.17%
salema	1.274	1.120	1.120	17.830	102.075	4.440	5.890	12.200	6.453	1.240	2.246	0.047	163.898	2.65%
northern anchovy	1.763	5.740	0.775	0.666	0.616	0.439	0.372	2.078	0.396	55.304	55.130	2.098	125.377	2.03%
swell shark	0.000	0.000	0.000	28.260	29.202	28.260	0.000	0.000	0.000	0.000	0.000	0.000	85.722	1.39%
giant seabass	0.000	0.000	0.000	65.000	0.000	0.000	0.000	0.000	0.000	0.341	0.330	0.013	65.684	1.06%
Pacific sardine	2.555	0.770	36.704	1.586	2.889	1.566	0.000	0.085	0.000	2.449	2.890	0.093	51.587	0.84%
deep body anchovy	0.068	11.046	0.558	0.000	0.000	0.000	0.000	0.000	0.400	16.058	17.164	0.609	45.903	0.74%
California scorpionfish	2.763	1.092	0.000	6.683	9.173	6.342	0.000	0.240	0.154	3.844	5.246	0.146	35.682	0.58%
specklefin midshipman	0.071	0.000	0.000	0.000	0.000	0.163	0.000	0.415	0.000	15.252	14.903	0.579	31.383	0.51%
topsmelt	0.287	0.000	0.000	3.420	3.874	6.426	4.805	6.365	5.002	0.000	0.086	0.000	30.265	0.49%
jack mackerel	0.000	0.000	0.000	0.231	15.949	0.493	0.000	4.870	0.000	2.449	4.283	0.093	28.368	0.46%
Total of top 15 species	223.439	244.846	65.627	831.333	915.814	769.821	210.087	1900.465	232.253	284.983	297.775	10.812	5987.255	96.95%
Total of all 69 species	238.127	251.244	70.091	839.897	961.096	788.338	222.611	1934.852	250.455	289.757	317.963	10.993	6175.425	100.00%

Table 4-4. Estimated Monthly Count of Fish Impinged at Unit 3 in 2007

Common Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	% of Total
queenfish	2544	22050	4541	32614	16322	16451	19312	29222	17885	24574	24069	24459	234043	77.82%
northern anchovy	668	3486	589	2477	2139	2078	101	279	682	4221	4654	4464	25837	8.59%
Pacific sardine	38	14	313	232	4015	3887	113	97	90	0	5	0	8804	2.93%
salema	106	126	810	617	16	36	627	742	98	388	798	372	4735	1.57%
kelp pipefish	239	518	602	30	0	0	0	4	0	88	90	93	3821	1.27%
deepbody anchovy	1015	602	2	30	0	0	0	0	0	442	504	465	3069	1.02%
slough anchovy	2004	280	0	0	0	0	0	0	0	0	0	0	2284	0.76%
plainfin midshipman	0	0	124	1231	341	330	0	0	0	0	0	0	2026	0.67%
yellowfin croaker	2	0	1	1	0	0	1111	700	4	17	62	0	1898	0.63%
jacksmelt	44	56	94	460	465	569	10	0	0	0	7	0	1705	0.57%
Pacific pompano	48	0	0	1	450	437	11	0	0	31	52	31	1061	0.35%
topsmelt	183	0	88	1	0	10	186	222	46	91	110	93	1029	0.34%
rockpool blenny	68	0	435	304	16	55	39	55	33	3	7	0	1014	0.34%
jack mackerel	1	0	0	15	78	211	80	282	3	32	171	31	904	0.30%
walleye surfperch	8	0	7	19	0	5	289	270	244	0	6	0	848	0.28%
Total of top 15 species	6,970	27,132	8,633	38,827	24,010	24,236	21,879	31,873	19,091	29,886	30,535	30,008	293,079	97.45%
Total of all 71 species	7585	27454	9123	39967	25219	25641	22492	32935	19277	30062	30849	30132	300736	100.00%

Table 4-5. Estimated Monthly Weight (Kgs) of Fish Impinged at Unit 3 in 2007

Common Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	% of Total
queenfish	11.763	127.470	30.600	311.550	410.177	410.684	174.086	263.048	149.798	77.473	78.980	75.516	2121.144	43.34%
Pacific electric ray	87.917	122.500	0.000	117.000	173.600	168.000	0.000	0.000	0.000	0.000	0.000	0.000	669.017	13.67%
yellowfin croaker	0.292	0.000	0.011	0.292	0.000	0.000	291.420	212.775	0.908	3.987	9.550	0.000	519.235	10.61%
Pacific sardine	0.893	0.574	12.069	9.067	175.863	170.285	4.560	4.237	3.900	0.000	0.156	0.000	381.604	7.80%
sargo	0.000	0.000	0.000	0.009	0.000	0.000	16.280	177.385	0.914	3.689	1.700	0.000	199.977	4.09%
California halibut	0.184	0.000	0.000	0.514	0.000	0.000	46.500	46.500	45.000	0.000	0.284	0.000	138.982	2.84%
jacksmelt	2.251	5.236	6.608	34.591	35.666	41.452	0.570	0.000	0.000	0.000	0.602	0.000	126.975	2.59%
salema	0.537	1.064	6.197	6.700	0.155	0.832	26.241	32.368	3.470	2.434	15.930	1.271	97.198	1.99%
mussel blenny	0.050	0.070	0.078	0.000	0.000	0.000	0.000	0.000	0.000	23.684	24.300	25.110	73.292	1.50%
plainfin midshipman	0.000	0.000	6.910	7.918	20.274	24.093	0.146	0.000	0.000	0.000	1.500	0.000	60.841	1.24%
jack mackerel	0.000	0.000	3.875	36.831	8.494	8.220	0.000	0.000	0.000	0.000	0.000	0.000	57.420	1.17%
Pacific chub mackerel	0.013	0.000	0.000	1.860	4.449	12.497	5.250	24.050	0.100	0.667	4.896	0.620	54.401	1.11%
northern anchovy	0.716	5.320	1.034	2.658	14.958	14.576	0.154	0.340	2.169	0.018	1.326	0.000	43.268	0.88%
Pacific pompano	8.463	7.644	8.493	4.425	1.178	2.745	0.000	2.201	1.845	0.000	0.000	0.000	36.994	0.76%
California lizardfish	0.581	0.000	0.000	0.025	16.167	15.728	0.408	0.000	0.000	0.945	1.650	0.930	36.434	0.74%
Total of top 15 species	113.66	269.88	75.87	533.44	860.98	869.11	565.62	762.90	208.10	112.90	140.87	103.45	4616.78	94.33%
Total of all 71 species	131.34	275.09	84.51	557.23	887.45	900.38	600.00	838.76	220.90	121.86	164.76	111.79	4894.06	100.00%

Heat Treatment Operations and Fish Chase.

Heat treatments are conducted on an "as needed" basis at coastal generating stations to control the growth of fouling organisms such as mussels and barnacles. The timing of these operations is dependent on season, ocean temperature, and observed settlement and growth of fouling organisms. The operations typically occur about every six weeks. The water temperature within the station is elevated to a temperature that will be lethal to the fouling organisms within the plant. Since this temperature is also lethal to fish residing in the station, a special operation called the fish chase has been developed at San Onofre to increase the number of fish returned to the ocean alive prior to a heat treatment. Table 4-6 summarizes the number and weight of fish returned to the ocean during the fish chase that occurs just prior to the heat treatment and the percent of those fish returned to the ocean compared to the number of fish killed during the heat treatment process at SONGS Units 2 and 3.

In 2007, a total of 3,352 kgs of fish were impinged during heat treatment operations at SONGS. At the same time, as a result of the "Fish Chase" procedure, 8,869 kgs of fish were successfully released back to the ocean prior to the heat treatments. The percentage of fish released varied among the heat treatments, but averaged 72.6% for the year. The percent of fish released during each fish chase varied from 25.6% to 96.7% of the total (i.e., fish chase divided by heat treatment plus fish chase) biomass.

**Table 4-6. Fish Chase Efficiency by Heat Treatment
for Units 2 and 3 in 2007**

Unit	Date	Fish Chase Kilograms	Heat Treatment Kilograms	Percent Released
Unit 2	1/26/2007	59.93	19.639	75.3%
Unit 2	4/4/2007	36.28	105.227	25.6%
Unit 2	5/18/2007	185.393	76.653	70.7%
Unit 2	5/27/2007	378.537	125.284	75.1%
Unit 2	6/30/2007	155.064	53.668	74.3%
Unit 2	8/4/2007	3551.27	1712.241	67.5%
Unit 2	9/15/2007	51.436	35.025	59.5%
Unit 2	11/11/2007	39.597	37.553	51.3%
Unit 2 Totals		4057.5	2166.29	67.3%
Unit 3	1/4/2007	42.107	5.862	87.8%
Unit 3	1/7/2007	10.58	5.039	67.7%
Unit 3	1/10/2007	27.839	5.528	83.4%
Unit 3	3/4/2007	23.66	21.9969	51.8%
Unit 3	4/25/2007	154.129	27.592	84.8%
Unit 3	6/2/2007	242.512	41.554	85.4%
Unit 3	7/7/2007	1008.55	379.895	72.6%
Unit 3	8/18/2007	2027.413	68.164	96.7%
Unit 3	8/27/2007	455.08	550.499	45.3%
Unit 3	9/29/2007	174.174	7.903	95.7%
Unit 3	10/3/2007	32.41	16.421	66.4%
Unit 3	11/17/2007	212.885	56.576	79.0%
Unit 3 Totals		4411.34	1187.06	78.8%
Overall Totals		8468.8	3353.35	72.6%

Table 4-7. Description of Fish Chase Operations in 2007

			Elevator					Heat Treatment				
			Intake Temp.	Max FC Temp.	Operational Status	# of Dumps	Condition of fish	No. of Fish	Fish Weight	No. of Fish	Fish Biomass	Comment
Unit	Date	Time										
2	1/26/07	2354	57.5	82	Good	20	Good	344	59.93	305	19.639	No unusual events
2	4/4/07	2101	58	82.1	Good	13	Good	2392	36.28	2503	105.227	No unusual events
2	5/18/07	2131	61	82	Good	15	Good	1829	185.39	1690	76.653	No unusual events
2	5/27/07	1545	62	83	Good	14	Good	7345	378.54	3508	125.284	No unusual events
2	6/30/07	1530	68	83.8	Good	13	Good	1316	155.06	720	53.668	No unusual events
2	8/4/07	0920	68	85.4	Good	27	Good	13220	3551.3	7465	1712.24	No unusual events
2	9/15/07	0850	59	83.4	Good	18	Good	1484	51.436	2499	35.025	Harbor seal rescue
2	11/11/07	0335	60.7	82.9	Good	18	Good	506	39.597	1957	37.553	No unusual events
3	1/4/07	0347	61	81	Good	15	Good	185	42.107	334	5.862	Cancelled. Seal
3	1/7/07	0517	57.4	81.7	Good	17	Good	257	10.58	494	5.039	Cancelled. Seal
3	1/10/07	2232	59	81	Good	9	Good	464	27.839	444	5.528	No unusual events
3	3/4/07	0351	54	77	Good	13	Good	117	23.66	1822	21.9969	No unusual events
3	4/25/07	1545	58.4	82	Good	17	Good	514	154.13	1057	27.592	No unusual events
3	6/2/07	1555	61	82	Good	17	Good	2616	242.51	1236	41.554	No unusual events
3	7/7/07	1204	68.5	85	Good	22	Good	7782	1008.6	3365	379.895	No unusual events
3	8/18/07	0939	69	85	Low Cond. Vac.	22	Good	12072	2027.4	2340	68.164	HT Postponed
3	8/27/07	1552	60.2	84	Good	21	Good	2627	455.08	11468	550.499	No unusual events
3	9/29/07	0900	65	83	Good	16	Good	6221	174.17	767	7.903	Seal present; Cancelled
3	10/3/07	1037	62	83.3	Sprocket loose	12	Good	1710	32.41	1641	16.421	No unusual events
3	11/17/07	1002	63	85	Good	18	Good	2485	212.89	1689	56.576	Seal Rescue

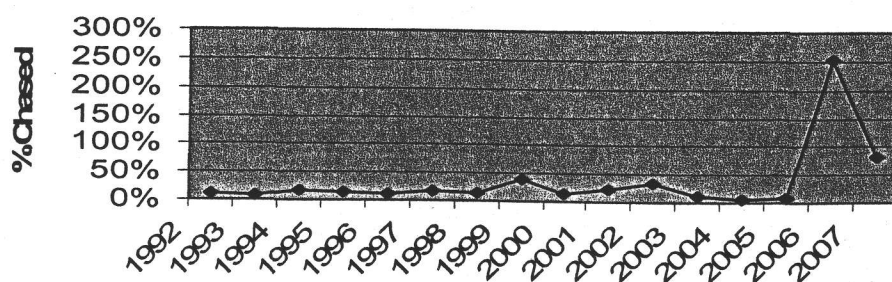
In Table 4-7 above, "Operational Status" provides information on the overall success of the fish chase procedure from an operational standpoint, i.e., whether it was completed as scheduled or not. "Condition of Fish" is a qualitative evaluation of how the fish appeared as they were released. A designation of "Good" means that less than 5% of the fish released appeared weakened or dead. The target temperature for a fish chase is usually 83°F. (28.3° C.) However, higher temperatures may be necessary to remove warm water species such as yellowfin croaker, sargo and zebra perch. In 2007, maximum temperatures ranged from 77° to 85.4° F. (25.0° to 29.7° C.). Graphs of temperature curves for each fish chase are presented in Appendix F. Table 4-8 presents a summary of fish released during the Fish Chase operations in 2007. The table provides the percent returned by numbers and biomass for the 15 most common species based on biomass. Appendix G provides the same information for all species taken at SONGS in 2007. Appendix H lists observations of species that may be of special interest to some researchers and resource managers.

Table 4-8. Summary of Fish Released During Fish Chase Operations in 2007 (Top 15 species by biomass).

Common Name	Unit 2 Fish Chase		Unit 2 Heat Treat		Unit 3 Fish Chase		Unit 3 Heat treat		% Returned by Count	% Returned by Biomass
	Number	Kgs	Number	Kgs	Number	Kgs	Number	Kgs		
yellowfin croaker	9017	3308.175	4087	1490.32	4161	1867.76	1898	519.235	68.77%	72.03%
spotfin croaker	674	228.261	62	21.75	3221	1308.59	50	18.793	97.20%	97.43%
sargo	322	50.46	1028	191.932	1188	332.418	800	200.08	45.24%	49.41%
salema	9059	333.189	4961	131.284	4329	176.125	2970	79.861	62.80%	70.69%
zebra perch	78	45.41	3	1.856	478	287.465	55	33.05	90.55%	90.51%
queenfish	3151	41.244	5822	98.493	3503	36.282	15594	168.004	23.71%	22.54%
giant seabass	3	101.25	1	65	3	84			85.71%	74.03%
jack mackerel	871	50.077	468	23.456	932	53.875	646	41.983	61.81%	61.37%
chub mackerel	965	101.342	202	20.356	250	27.92	7	0.01	85.32%	86.39%
California electric ray	5	75	1	11.25	2	45			87.50%	91.43%
barred sand bass	244	39.002	104	15.383	287	45.257	169	18.903	66.04%	71.08%
jacksmelt	66	4.44	219	16.96	610	35.649	417	29.249	51.52%	46.45%
northern anchovy	3645	9.286	1216	3.872	16536	33.63	1319	4.198	88.84%	84.17%
bat ray	4	33	2	0.65	1	5	1	0.333	62.50%	97.48%
Pacific sardine	7	0.264	77	2.173	1219	33.812	46	1.548	90.88%	90.16%
Totals for Top 15 species	28111	4420.40	18253	2094.74	36720	4372.78	23972	1115.25	60.56%	73.26%
Totals for all 78 species	28436	4458	20647	2165	37050	4411	26657	1187	58.06%	72.57%

When the annual biomass of fish returned during the fish chase procedure is compared to the total estimated impingement biomass for the year, fish chase biomass is usually equal to less than 50% of the total impinged biomass at SONGS. However, in 2006 the biomass released during the fish chase was two and a half times (254%) the total estimated fish loss. In 2007 the fish chase released an amount of fish equal to 81% of the total estimated impingement (Figure 4-1).

Figure 4-1. Percent of Total Biomass Returned in Fish Chase



Fish Return System Operation

The SONGS fish return system is normally operated twice per day by station operators. It is a routine part of station operations that is logged on daily status sheets (Form SO123-0-10) (M. J. Johnson, Personal Communication). A summary of exceptions to daily operability of the fish return system in 2007 is detailed in Table 4-9.

Eleven years of data were collected from 1984 through 1994 to characterize the return efficiency of the fish return system. In 1999, an additional special study was conducted of the system and beginning in March 2006 another one-year study was begun as part of a program of data collection for a 316(b) demonstration. This annual report includes a summary of FRS data taken from January through May 2007. A summary of data on the return efficiency of the FRS during all the studies is presented in Table 4-10. Return efficiency is the percent of fish returned to the fish return sluiceway during normal operation compared to the number of fish impinged and does not include fish returned during the fish chase operation.

Table 4-9. Operating status of the Fish Return System in 2007

Unit	Total Hours FRS Out of Service in 2006	Reason FRS was Out of Service.	% System Availability in 2006
2	--	--	100
3	24	Maintenance inspection	99.7

Table 4-10 Fish Biomass Return Efficiency 1984-1994, 1999, 2006 and 2007.

Year	Unit 2 % Returned	Unit 3 % Returned
1984	96.5	95.4
1985	88.3	60.1
1986	75	69.9
1987	65	67.8
1988	80	68.5
1989	41.6	58.4
1990	51.5	36.6
1991	75.4	66.3
1992	74.4	59.3
1993	83	78
1994	87.7	78.4
1999	72.4	68.22
2006	92.7	93.0
2007	71.6	64.7
Average	75.4	68.9

Table 4-11 provides a summary of FRS efficiency in 2007. The table includes the top 15 species ranked by total estimated biomass in paired impingement and FRS samples. Appendices I and J show return efficiencies for all species that occurred during the paired samples.

Table 4-11. Fish Return System Efficiency in 2007

Species	Returned Fish		Impinged Fish		% Return	% Return	Total Biomass
	Total No.	Total Kgs	Total No.	Total Kgs	Abun	Kgs.	
UNIT 2							
Pacific electric ray	2	50	4	33	33.33%	60.24%	83.000
queenfish	6274	59.118	2010	12.754	75.74%	82.25%	71.872
jack smelt	122	20.345	97	7.841	55.71%	72.18%	28.186
salema	2181	20.557	68	0.441	96.98%	97.90%	20.998
bat ray	2	5.727			100.00%	100.00%	5.727
deepbody anchovy	314	2.949	220	1.624	58.80%	64.49%	4.573
Pacific sardine	97	2.916	48	1.444	66.90%	66.88%	4.360
northern anchovy	666	2.454	359	0.558	64.98%	81.47%	3.012
walleye surfperch	73	2.246			100.00%	100.00%	2.246
black perch	8	1.434	1	0.004	88.89%	99.72%	1.438
California scorpionfish	14	1.327			100.00%	100.00%	1.327
chub mackerel	13	1.025	1	0.108	92.86%	90.47%	1.133
swell shark			1	0.942	0.00%	0.00%	0.942
slough anchovy	13	0.034	294	0.849	4.23%	3.85%	0.883
topsmelt	23	0.693	3	0.124	88.46%	84.82%	0.817
Totals for top 15 species	9802	170.825	3106	59.689	75.94%	74.11%	230.514
Totals for all species	9871	173.815	3326	69.006	74.80%	71.58%	3491.073
UNIT 3							
queenfish	7028	96.639	5173	58.305	57.60%	62.37%	154.944
jack smelt	935	82.227	55	4.153	94.44%	95.19%	86.380
Pacific electric ray	4	45	4	33	50.00%	57.69%	78.000
Pacific sardine	154	6.187	297	12.787	34.15%	32.61%	18.974
California butterfly ray	2	15.7			100.00%	100.00%	15.700
salema	1066	10.358	37	0.292	96.65%	97.26%	10.650
leopard shark	1	10			100.00%	100.00%	10.000
chub mackerel	76	6.787	27	2.18	73.79%	75.69%	8.967
spotfin croaker	15	6.304	1	0.091	93.75%	98.58%	6.395
northern anchovy	964	2.76	619	1.609	60.90%	63.17%	4.369
plainfin midshipman			112	3.248	0.00%	0.00%	3.248
white croaker	49	2.583	17	0.282	74.24%	90.16%	2.865
walleye surfperch	89	2.373	1	0.011	98.89%	99.54%	2.384
bat ray	3	1.2	2	0.541	60.00%	68.93%	1.741
deepbody anchovy	117	0.917	97	0.703	54.67%	56.60%	1.620
Totals for top 15 species	10503	289.035	6442	117.202	61.98%	71.15%	406.237
Totals for all species	10673	294.572	7030	160.828	60.29%	64.68%	2055.295

LENGTH FREQUENCY ANALYSIS

Figures 4-2 through 4-5 present length-frequency distributions of queenfish, northern anchovy, white croaker and Pacific sardine collected in-plant at Units 2 and 3 during 2007. These species were selected either because of their predominance in the catch (e.g., queenfish and northern anchovy) or because of their interest to resource managers (e.g., Pacific sardine and white croaker). Length data for all other species is provided in the 2007 data report and includes all length data collected in normal operation, heat treatment and fish return samples.

Fig. 4-2. Queenfish Lengths

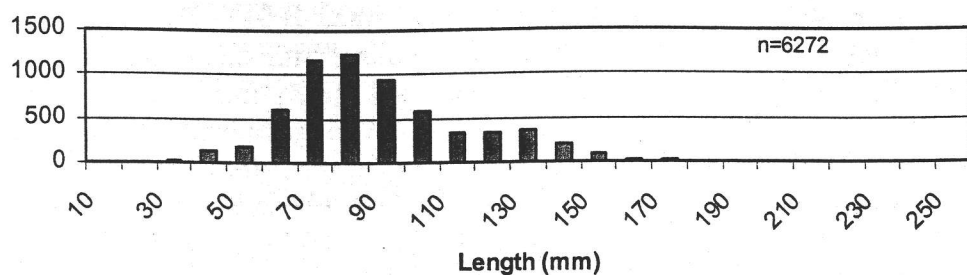


Fig. 4-3. Northern Anchovy Lengths

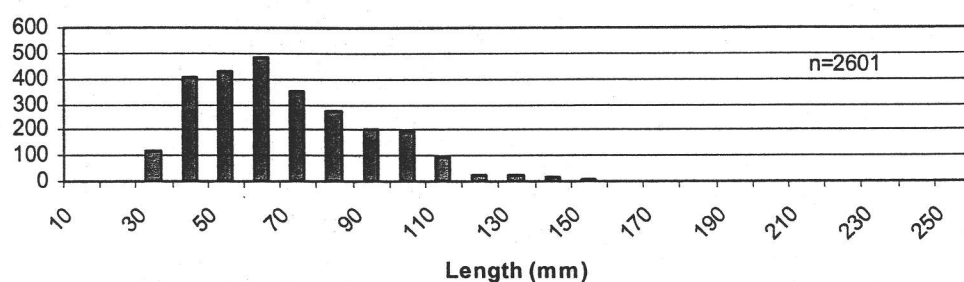


Fig. 4-4. White Croaker Lengths

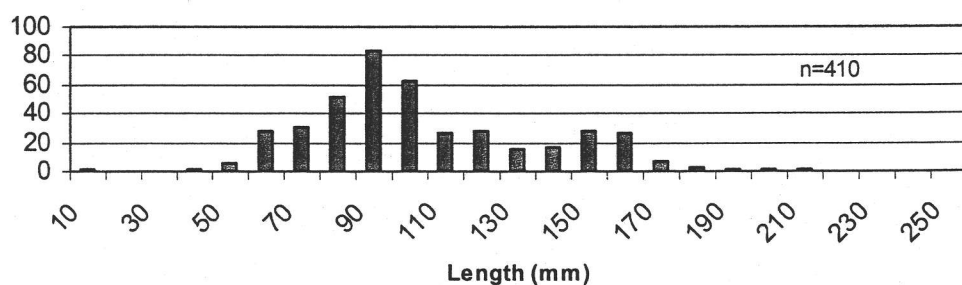
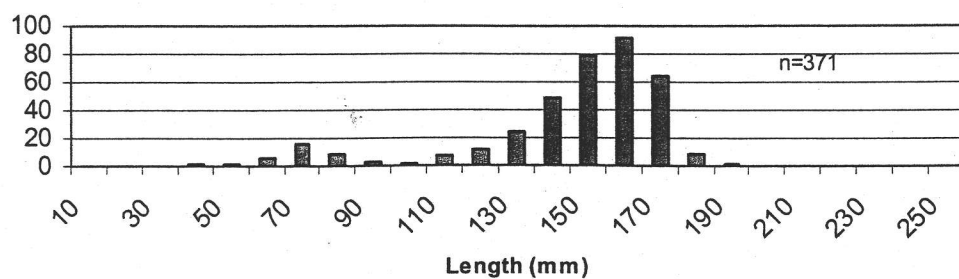


Fig. 4-5. Pacific Sardine Lengths



Queenfish: Queenfish lengths ranged from 30 to 170 mm. The length distribution appears unimodal but more likely represents two superimposed modes at 80 and 130 mm representing mostly Age 0 and Age 1 individuals. These are the same modes seen each year since 2001. The range of lengths collected in 2007 includes many smaller individuals due to sampling with smaller mesh size in fish return samples. The annual abundance of queenfish has fluctuated greatly from year to year with an apparent relationship with ENSO (El Niño/La Niña) events. Though abundance has remained generally strong during both warm and cool water periods, there were marked declines during the strong warm-water ENSO events of 1982-83, 1987 and 1997-98. In 1999 and 2000, cold water years, queenfish abundance was approximately double that of 1998. In 2007, queenfish were the most numerous fish at both Units 2 and 3 and also contributed the greatest biomass at both units.

Northern anchovy: In 2007, as in 2004 and 2005, northern anchovy lengths ranged mostly from 30 to 150 mm throughout the year. Length modes likely follow the usual pattern of approximately 50, 90, 120 and 150 mm, but are superimposed and difficult to determine. The smaller size class (around 50 mm) correlates to an age of 1.5 to 2.5 months (Sakagawa and Kimura 1976). Annual northern anchovy impingement has ranged from 13,329 individuals (1998) to 3,777,680 individuals (2005). Average annual impingement was 990,801 individuals weighing 4,711 kg (10,387 lbs.) Abundance in 2007 was considerably lower than average. Though usually abundant, the northern anchovy biomass fluctuates greatly. This may be a result of global changes such as El Niño/La Niña conditions or just the patchiness of their distribution along the coast. In 2007, northern anchovies accounted for 7.22% and 8.59% of the total number of fish impinged at Units 2 and 3, respectively, and only 2.03% and 0.88%, respectively, of the biomass.

White croaker: In 2007 the primary length modes for white croaker were approximately 60, 100, and 150 mm. As in 2006, most were less than 150 mm, and therefore, immature. Unlike queenfish, whose abundance has fluctuated from year to year but has not shown any long-term decline, white croaker abundance over the same period exhibited an overall downward trend, with occasional noteworthy increases, such as seen in 1999 and 2000, likely related to episodes of cooler water temperatures. From 1984 through 2005, average annual impingement was 50,731 individuals weighing 421 kg. (921 lbs). In 2007, white croaker numbers continued to decrease with only 1,644 individuals weighing 30.79 kg (67.88 lbs).

Pacific sardines: As in 2006, there were two distinct length modes in 2007, one 70 mm and one at 160 mm, however, in 2007 the majority of fish were in the larger length mode. Following the extremely high Pacific sardine catches of years 2004 and 2005, numbers fell precipitously in 2006 and continued at a low level in 2007. Pacific sardines ranked eighth and third in numeric abundance at Units 2 and 3, respectively, and tenth and fourth in biomass at Units 2 and 3, respectively. Unit 2 had an estimated 1,633 individuals at 51.59 kg. while Unit 3 had 8,804 individuals weighing 381.6 kg. The lower estimated numbers and biomass of Pacific sardines in 2006 and 2007, and the dramatic decline from 2005, suggest that the extremely high catch estimates of 2004 and 2005 were a result of dense, but patchy, concentrations of sardines near shore, and infrequent sampling that caught only the peaks in the occurrence of the sardines.

SEX COMPOSITION

Sex ratios of fish impinged at Units 2 and 3 are summarized in Table 4-12. As observed in past years, females frequently outnumbered males for many of the species studied. This is especially true of some of the perches, white croaker, and queenfish. This may be due to increased vulnerability to impingement of gravid females, especially the embiotocids that may have impaired swimming ability. These characteristics are consistent with data from previous years.

Table 4-12. Count by Sex of fish captured at SONGS in 2007

Common Name	Gender		% Female
	Female	Male	
deepbody anchovy	42	48	46.67%
sargo	146	148	49.66%
kelp surfperch	4		100.00%
white seabass		4	0.00%
swell shark		1	0.00%
black croaker	39	33	54.17%
shiner surfperch	271	127	68.09%
California moray		1	0.00%
black perch	29	9	76.32%
northern anchovy	111	69	61.67%
white croaker	98	53	64.90%
California butterfly ray	1	1	50.00%
rock wrasse	5	11	31.25%
zebra perch		3	0.00%
horn shark	1	1	50.00%
walleye surfperch	88	49	64.23%
California corbina	1		100.00%
dwarf surfperch	2		100.00%
gray smoothhound	1		100.00%
bat ray	3	3	50.00%
kelp bass	5	6	45.45%
Barred sand bass	70	36	66.04%
California halibut	1		100.00%
Pacific butterfish	62	27	69.66%
white surfperch	35	5	87.50%
shovelnose guitarfish		1	0.00%
rubberlip seaperch	7		100.00%
pile perch	2		100.00%
spotfin croaker	17	57	22.97%
Pacific sardine	86	97	46.99%
queenfish	643	489	56.80%
Pacific electric ray	6	1	85.71%
yellowfin croaker	132	151	46.64%
round stingray	5	1	83.33%

TOTAL IMPINGEMENT

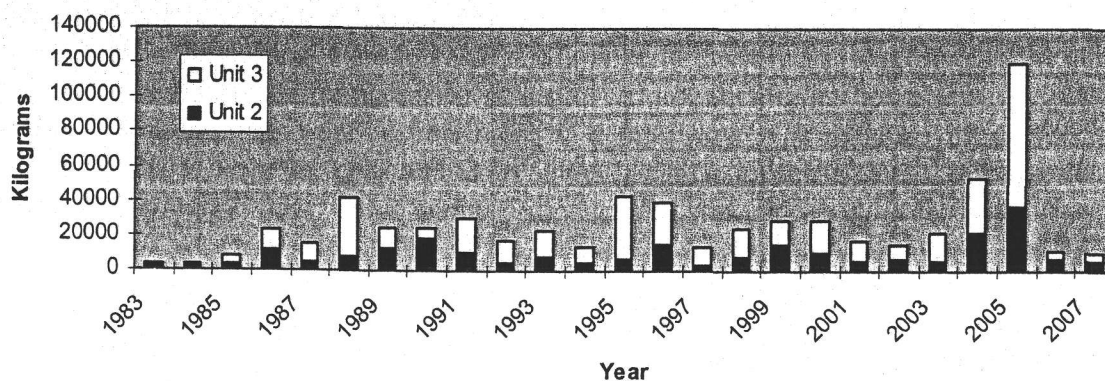
The total impingement fish loss for 2007 is the sum of the estimated annual impingement loss during normal operation plus fish impinged during heat treatment. Estimated annual impingement for Unit 2 in 2007, for all species combined, was 379,436 fish weighing 6,175 kilograms. Annual impingement at Unit 3 was 300,736 fish weighing 4,894 kilograms (Table 4-13).

Table 4-13. Total number and weight of fish caught at San Onofre Units 2 & 3 in 2007

Unit	Normal Operation Impingement Total	Heat Treatment Total	Total Fish Impingement
2 (Count)	358,789	20,647	379,436
2 (Kilograms)	4,010	2,165	6,175
3 (Count)	274,079	26,657	300,736
3 (Kilograms)	3,707	1,187	4,894

The estimated total fish impingement biomass for SONGS in 2007 (11,069 kg) was very similar to the estimated 2006 total of 11,423 kgs. (Figure 4-6). While 2005 had the highest estimated impingement ever recorded, 2006 and 2007 were among the lowest levels of impingement. Several factors may have influenced the change: an apparent reduction in Pacific sardine densities near the station intakes, increased sampling frequency and resultant increase in accuracy of estimates.

Fig. 4-6. SONGS Impingement 1983-2007



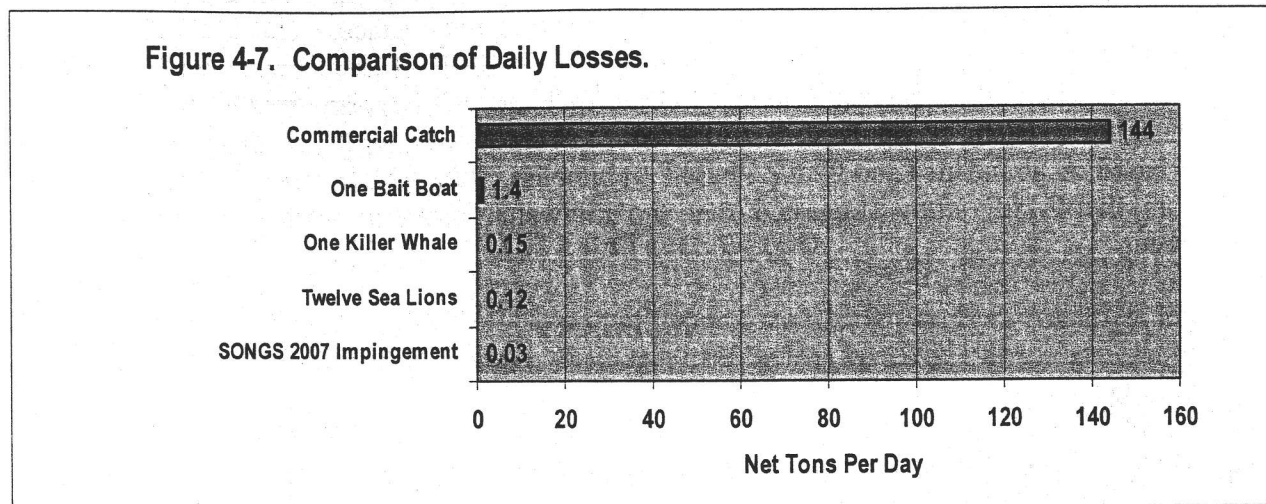
Sampling effort during the first four months of 2007 was increased from quarterly to bi-weekly as part of the 316(b) sampling plan. Logically, the increased number of samples should have resulted in increased accuracy of the impingement estimate. As postulated in the 2005 Annual Analysis Report, the extremely high impingement estimate for 2005 may have been anomalous because of the small number of samples taken to determine estimates of normal operation impingement.

COMPARISON TO OTHER SOURCES OF FISH LOSS

This report provides an estimate of fish loss due to impingement resulting from the use of seawater as a source of cooling water for the San Onofre Nuclear Generating Station. In order to put these losses

in perspective, it may be useful to compare the impingement losses with other losses routinely experienced by Southern California fish populations.

Figure 4-7 presents a variety of stresses on local fish populations and their relative magnitude in relation to SONGS impingement.



Data source: ¹ California Living Marine Resources, p. 57, CDFG, 2001. So. Cal coastal pelagics only. ²C. Cooney, Cal F&G, pers. com.; ³⁻⁴ "Marine Mammals of California" by A.E. Daugherty, 1979; ⁵2007 Songs Annual Analysis Report.

SUMMARY OF STUDIES CONDUCTED UNDER SECTION 316(b) OF THE CLEAN WATER ACT

SCE completed and submitted a Comprehensive Demonstration Study (CDS) to the San Diego RWQCB in January 2008 (EPRI, 2008). This study analyzed the impingement and entrainment levels of fish, fish eggs, fish larvae, invertebrates, invertebrate eggs, and invertebrate larvae. This data spanned parts of two calendar years, 2006 and 2007, and impingement and fish return data collected during the study has been incorporated into this Annual Report and in the 2006 Annual Report. However, the CDS combines data for the entire study period. The study also analyzed currently available marine resource protection technologies and determined their feasibility at SONGS.

A year-long Impingement Mortality and Entrainment Study (IM&E) was conducted as part of the CDS (MBC 2007) and also spanned parts of two years. This involved bi-weekly sampling of the impingement and entrainment within the plant, as well as monthly off-shore sampling from March 2006 to May 2007. The IM&E Study enumerated the fish and invertebrates (as well as their eggs and larvae) and compared this with historical data. During the study, approximately 1,353,000 fishes weighing 13,037 kg were estimated to be impinged. Queenfish was the most abundant species, followed by northern anchovy and then Pacific sardine. Normal operations accounted for 97% of the fish abundance and 63% of the biomass.

Entrainment was estimated to be 1.1 to 1.4 billion larvae per unit and 13 to 14 billion fish eggs. The most abundant taxa of fish larva collected were northern anchovy, unidentified anchovy, clinid kelpfishes, and queenfish. The most abundant fish egg taxa collected were unidentified fish eggs and

anchovy eggs. There was a peak in larval abundance in early April 2006 for Unit 2, and late-May 2006 at Unit 3. Concentrations were highest from April through July 2006 at both units.

The study also estimated the calculation baseline by which the plant would be compared to determine how effectively SONGS has reduced the amount of impingement and entrainment with current technologies. As defined in Section 316(b), the baseline is an intake that is on the shoreline, with 3/8 inch traveling screens oriented parallel to the flow, and at the surface. The SONGS intake differs greatly from this in that it has an offshore, submerged intake with a velocity cap and is equipped with a fish return system. The estimated efficiency of the SONGS velocity caps was 88.17%, coupled with the Fish Return System, the estimated reduction in the amount of adult fish impinged at the plant is 94.22% based on abundance and 97.65% based on biomass. Although, a reduction was not estimated, data from the IM&E study suggested that the midwater, offshore intakes significantly reduced entrainment.

SUMMARY

IMPINGEMENT

Overall, the weight of fish impinged at San Onofre Units 2 and 3 in 2007 was 63.0% and 28.4 %, respectively, of the 25-year average. Unit 2 is well within the range of values recorded since Unit 2 began operation. Unit 3 impingement increased slightly from 2006, which was the lowest estimated impingement since 1983, when the unit was beginning operation.

Unit 1

San Onofre Unit 1 was taken out of service in 1992. It did not operate in 2007, and is not considered in this report.

Unit 2

A total of 69 species of fish were counted and weighed at Unit 2 in 2007. When weighted by the total amount of seawater used by Unit 2 in 2007, the estimated fish impingement was 379,436 individuals weighing 6,175 kilograms. The top 15 species accounted for 99.02% of the total number and 96.95% of the total weight. Queenfish were the most numerous species contributing 81.36% of the total number of fish. Queenfish also contributed the most weight at Unit 2, contributing 25.25% of the total biomass.

Unit 3

A total of 71 species of fish were counted and weighed at Unit 3 in 2007. When weighted by the total amount of seawater used by Unit 3 in 2007, the estimated fish impingement was 300,736 individuals weighing 4,894 kilograms. The top 15 species accounted for 97.45% of the total number and 94.33% of the total weight. Queenfish were the most numerous species contributing 77.82% of the total number of fish. Queenfish also contributed the greatest weight with 43.34% of the total biomass.

FISH CHASE

A special procedure called a "fish chase" has been developed at San Onofre to cause fish to leave the circulating water system before heat treatments begin. In 2007, a total of 3,352 kgs of fish were

impinged during heat treatment operations at SONGS. At the same time, as a result of the "Fish Chase" procedure, 8,869 kgs of fish were successfully released back to the ocean prior to the heat treatments. The percentage of fish released varied among the heat treatments, but averaged 72.6% for the year.

* * * *

There is no evidence that fish impingement at SONGS has significantly impacted the maintenance of a balanced, indigenous fish population in the receiving water, or impaired any beneficial uses dependent on the fisheries resources.

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APPENDIX A-1

List of Heat Treatment, Fish Chase, Normal Operation and Fish Return Samples at SONGS Unit 2 in 2007.

Appendix A-1. Fish Samples Taken in 2007

Unit	Date	Sample Type	Fish Nos.	Biomass (Kgs.)
Unit 2	01/09/07	Normal Operation	653	8.671
Unit 2	01/09/07	Fish Return	667	12.121
Unit 2	01/23/07	Normal Operation	117	7.962
Unit 2	01/23/07	Fish Return	309	13.007
Unit 2	01/26/07	Fish Chase	344	59.930
Unit 2	01/27/07	Heat Treat	305	19.639
Unit 2	02/06/07	Normal Operation	606	12.871
Unit 2	02/06/07	Fish Return	1305	41.536
Unit 2	02/20/07	Normal Operation	179	0.681
Unit 2	02/20/07	Fish Return	48	0.974
Unit 2	02/21/07	Normal Operation	814	4.394
Unit 2	02/21/07	Fish Return	1698	18.620
Unit 2	03/05/07	Normal Operation	41	0.257
Unit 2	03/05/07	Fish Return	125	2.480
Unit 2	03/06/07	Normal Operation	200	2.004
Unit 2	03/06/07	Fish Return	1162	13.046
Unit 2	03/20/07	Fish Return	447	28.790
Unit 2	04/02/07	Normal Operation	193	8.389
Unit 2	04/02/07	Fish Return	459	25.894
Unit 2	04/03/07	Normal Operation	523	16.100
Unit 2	04/03/07	Fish Return	4098	46.137
Unit 2	04/04/07	Fish Chase	2392	36.280
Unit 2	04/04/07	Heat Treat	2503	105.227
Unit 2	05/18/07	Fish Chase	1829	185.393
Unit 2	05/18/07	Heat Treat	1690	76.653
Unit 2	05/27/07	Fish Chase	7345	378.537
Unit 2	05/27/07	Heat Treat	3508	125.284
Unit 2	06/30/07	Fish Chase	1316	155.064
Unit 2	06/30/07	Heat Treat	720	53.668
Unit 2	07/31/07	Normal Operation	1473	7.181
Unit 2	08/04/07	Fish Chase	13220	3551.270
Unit 2	08/04/07	Heat Treat	7465	1712.241
Unit 2	09/15/07	Fish Chase	1484	51.436
Unit 2	09/15/07	Heat Treat	2499	35.025
Unit 2	11/11/07	Fish Chase	506	39.597
Unit 2	11/11/07	Heat Treat	1957	37.553
Unit 2	11/27/07	Normal Operation	2012	9.347

APPENDIX A-2

List of Heat Treatment, Fish Chase, Normal Operation and Fish Return Samples at SONGS Unit 3 in 2007.

Appendix A-2. Fish Samples Taken in 2007

Unit	Date	Sample Type	Fish Nos.	Biomass (Kgs.)
Unit 3	01/04/07	Fish Chase	185	42.107
Unit 3	01/04/07	Heat Treat	334	5.862
Unit 3	01/07/07	Fish Chase	257	10.580
Unit 3	01/07/07	Heat Treat	494	5.039
Unit 3	01/09/07	Normal Operation	330	1.496
Unit 3	01/09/07	Fish Return	407	1.807
Unit 3	01/10/07	Fish Chase	464	27.839
Unit 3	01/11/07	Heat Treat	444	5.528
Unit 3	01/23/07	Normal Operation	47	5.366
Unit 3	01/23/07	Fish Return	368	3.006
Unit 3	02/06/07	Normal Operation	311	1.704
Unit 3	02/06/07	Fish Return	831	5.553
Unit 3	02/20/07	Normal Operation	543	2.883
Unit 3	02/20/07	Fish Return	79	2.460
Unit 3	02/21/07	Normal Operation	1107	15.062
Unit 3	02/21/07	Fish Return	1104	27.860
Unit 3	03/04/07	Fish Chase	117	23.660
Unit 3	03/04/07	Heat Treat	1822	21.997
Unit 3	03/05/07	Normal Operation	32	0.344
Unit 3	03/05/07	Fish Return	155	5.050
Unit 3	03/06/07	Normal Operation	221	0.911
Unit 3	03/06/07	Fish Return	384	5.360
Unit 3	03/20/07	Normal Operation	218	2.778
Unit 3	03/20/07	Fish Return	447	28.790
Unit 3	04/02/07	Normal Operation	400	4.206
Unit 3	04/02/07	Fish Return	1398	55.192
Unit 3	04/03/07	Normal Operation	1434	11.928
Unit 3	04/03/07	Fish Return	1998	50.945
Unit 3	04/17/07	Normal Operation	760	19.175
Unit 3	04/17/07	Fish Return	1383	20.387
Unit 3	04/25/07	Fish Chase	514	154.129
Unit 3	04/25/07	Heat Treat	1057	27.592
Unit 3	05/01/07	Normal Operation	160	2.350
Unit 3	05/01/07	Fish Return	305	14.941
Unit 3	05/15/07	Normal Operation	1467	54.905
Unit 3	05/15/07	Fish Return	1814	73.221
Unit 3	06/02/07	Fish Chase	2616	242.512
Unit 3	06/02/07	Heat Treat	1236	41.554
Unit 3	07/07/07	Fish Chase	7782	1008.550
Unit 3	07/07/07	Heat Treat	3365	379.895
Unit 3	07/31/07	Normal Operation	617	7.100
Unit 3	08/18/07	Fish Chase	12072	2027.413
Unit 3	08/18/07	Heat Treat	2340	68.164
Unit 3	08/27/07	Fish Chase	2627	455.080
Unit 3	08/27/07	Heat Treat	11468	550.499
Unit 3	09/29/07	Fish Chase	6221	174.174
Unit 3	09/29/07	Heat Treat	767	7.903
Unit 3	10/03/07	Fish Chase	1710	32.410
Unit 3	10/03/07	Heat Treat	1641	16.421
Unit 3	11/17/07	Fish Chase	2485	212.885
Unit 3	11/17/07	Heat Treat	1689	56.576
Unit 3	11/27/07	Normal Operation	972	3.606

APPENDIX B.

**Estimated Monthly Number of Fish Impinged
at SONGS Unit 2 in 2007.**

Appendix B. Estimated Monthly Number of Fish at SONGS Unit 2 in 2007

Common Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
queenfish	640	15526	2883	17276	18450	17155	44578	45462	45280	50220	49351	1905	308726
northern anchovy	1181	3262	403	1164	1191	1145	186	1022	201	8649	8669	328	27401
jacksmelt	55	28	0	2873	2936	2767	0	3	1	0	3	0	8666
salema	248	196	1240	1679	2952	171	186	368	203	434	570	16	8263
deep body anchovy	23	1260	62	0	0	0	0	0	26	2263	2323	86	6042
yellowfin croaker	2	42	0	2	6	31	62	4086	62	31	50	1	4375
kelp pipefish	372	924	1612	273	282	270	0	0	0	310	302	12	4357
Pacific sardine	113	56	1085	61	90	61	0	28	0	62	75	2	1633
shiner perch	2	0	31	66	216	34	155	407	151	0	2	0	1064
sargo	22	0	0	0	1	32	0	894	55	0	40	0	1044
slough anchovy	0	868	93	0	0	0	0	0	0	0	0	0	961
white croaker	102	0	31	4	68	0	124	208	154	124	127	5	947
rockpool blenny	110	14	0	149	124	37	0	2	129	31	339	1	936
topsmelt	22	0	0	60	71	139	124	164	126	0	2	0	708
jack mackerel	0	0	0	5	314	14	0	75	0	62	120	2	592
California scorpionfish	129	14	0	69	117	66	0	3	4	31	40	1	474
walleye surfperch	2	0	0	8	6	0	124	175	123	0	2	0	440
giant kelpfish	1	84	0	32	35	30	0	3	1	62	61	2	311
speckled sanddab	124	0	31	0	6	0	31	31	30	0	0	0	253
chub mackerel	0	14	0	16	181	0	0	0	0	0	5	0	216
barcheek pipefish	0	0	0	60	62	60	0	0	0	0	0	0	182
Pacific pompano	78	0	0	0	5	6	0	4	2	31	31	1	158
white seaperch	0	0	0	4	26	8	31	38	32	0	0	0	139
California electric ray	32	14	0	30	31	30	0	0	0	0	0	0	137
barred sand bass	29	0	0	3	14	1	0	10	15	0	48	0	120
black perch	3	0	0	33	44	30	0	8	1	0	0	0	119
spotted kelpfish	93	0	0	0	4	4	0	11	1	0	0	0	113
bocaccio	0	14	0	30	31	30	0	0	0	0	0	0	105
California halibut	1	0	0	0	3	0	31	31	32	0	2	0	100
white seabass	0	0	0	0	0	0	31	32	30	0	3	0	96
swell shark	0	0	0	30	31	30	0	0	0	0	0	0	91

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Common Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	
specklefin midshipman	17	0	0	0	0	0	1	0	1	0	31	38	1	89
cabezon	2	28	0	32	22	0	0	0	0	0	0	0	0	84
Pacific barracuda	0	0	0	0	0	0	0	0	0	0	31	40	1	72
spotfin croaker	1	0	0	0	9	26	0	27	0	0	0	0	0	63
black croaker	2	0	0	6	2	7	0	13	12	0	15	0	0	57
senorita	0	28	0	0	2	0	0	3	2	0	5	0	0	40
Pacific staghorn sculpin	31	0	0	0	0	0	0	1	0	0	1	0	0	33
blacksmith	5	0	0	0	4	0	0	4	2	0	15	0	0	30
California grunion	0	0	0	0	19	2	0	0	1	0	5	0	0	27
plainfin midshipman	6	0	0	5	15	0	0	0	0	0	0	0	0	26
crevice kelpfish	0	0	0	0	0	0	0	0	0	0	22	0	0	22
kelpbass	0	0	0	0	3	4	0	3	4	0	4	0	0	18
rock wrasse	1	0	0	0	2	2	0	5	6	0	0	0	0	16
thornback	16	0	0	0	0	0	0	0	0	0	0	0	0	16
California lizardfish	0	14	0	0	0	0	0	0	0	0	0	0	0	14
basketweave cusk-eel	0	0	0	4	5	0	0	0	1	0	2	0	0	12
brown rockfish	3	0	0	1	6	0	0	1	0	0	0	0	0	11
round stingray	0	0	0	1	1	2	0	0	0	0	1	0	0	5
striped kelpfish	4	0	0	0	0	0	0	0	1	0	0	0	0	5
spotted turbot	0	0	0	1	0	0	0	0	0	0	3	0	0	4
vermillion rockfish	0	0	0	1	2	0	0	0	0	0	0	0	0	3
zebra perch	0	0	0	0	0	3	0	0	0	0	0	0	0	3
bat ray	0	0	0	0	1	0	0	1	0	0	0	0	0	2
grass rockfish	0	0	0	1	1	0	0	0	0	0	0	0	0	2
halfmoon	1	0	0	0	0	0	0	1	0	0	0	0	0	2
horn shark	0	0	0	0	0	0	0	1	0	0	1	0	0	2
kelp perch	0	0	0	0	0	0	0	2	0	0	0	0	0	2
California corbina	0	0	0	1	0	0	0	0	0	0	0	0	0	1
California moray	0	0	0	0	0	1	0	0	0	0	0	0	0	1
California tonguefish	0	0	0	1	0	0	0	0	0	0	0	0	0	1
dwarf perch	0	0	0	1	0	0	0	0	0	0	0	0	0	1
garibaldi	0	0	0	0	1	0	0	0	0	0	0	0	0	1
giant seabass	0	0	0	1	0	0	0	0	0	0	0	0	0	1
opaleye	0	0	0	0	0	1	0	0	0	0	0	0	0	1
pipefish, unid.	0	0	0	0	0	0	0	0	1	0	0	0	0	1
spotted cusk-eel	0	0	0	0	1	0	0	0	0	0	0	0	0	1
spotted sand bass	0	0	0	0	1	0	0	0	0	0	0	0	0	1
treefish	1	0	0	0	0	0	0	0	0	0	0	0	0	1
spotfin surfperch	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3467	22386	7471	23983	27394	22200	45663	53128	46689	62372	62317	2366	379436	

APPENDIX C.

**Estimated Monthly Catch in Kilograms of Fish
at SONGS Unit 2 in 2007.**

Appendix C. Estimated Monthly Catch in Kilograms at SONGS Unit 2 in 2007

Common Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
queenfish	2.874	83.202	18.507	156.116	182.959	161.424	178.250	204.692	189.755	186.434	188.034	7.073	1559.320
yellowfin croaker	0.240	0.000	0.000	0.275	0.705	7.300	20.770	1501.210	20.270	1.612	2.754	0.061	1555.197
California electric ray	201.900	140.000	0.000	321.000	331.700	321.000	0.000	0.000	0.000	0.000	0.000	0.000	1315.600
jacksmelt	5.689	1.876	0.000	230.266	236.586	222.368	0.000	0.022	0.017	0.000	0.624	0.000	697.448
sargo	3.958	0.000	0.000	0.000	0.086	9.600	0.000	168.288	9.806	0.000	4.085	0.000	195.823
salema	1.274	1.120	9.083	17.830	102.075	4.440	5.890	12.200	6.453	1.240	2.246	0.047	163.898
northern anchovy	1.763	5.740	0.775	0.666	0.616	0.439	0.372	2.078	0.396	55.304	55.130	2.098	125.377
swell shark	0.000	0.000	0.000	28.260	29.202	28.260	0.000	0.000	0.000	0.000	0.000	0.000	85.722
giant seabass	0.000	0.000	0.000	65.000	0.000	0.000	0.000	0.000	0.000	0.341	0.330	0.013	65.684
Pacific sardine	2.555	0.770	36.704	1.586	2.889	1.566	0.000	0.085	0.000	2.449	2.890	0.093	51.587
deep body anchovy	0.068	11.046	0.558	0.000	0.000	0.000	0.000	0.000	0.400	16.058	17.164	0.609	45.903
California scorpionfish	2.763	1.092	0.000	6.683	9.173	6.342	0.000	0.240	0.154	3.844	5.246	0.146	35.682
specklefin midshipman	0.071	0.000	0.000	0.000	0.000	0.163	0.000	0.415	0.000	15.252	14.903	0.579	31.383
topsmelt	0.287	0.000	0.000	3.420	3.874	6.426	4.805	6.365	5.002	0.000	0.086	0.000	30.265
jack mackerel	0.000	0.000	0.000	0.231	15.949	0.493	0.000	4.870	0.000	2.449	4.283	0.093	28.368
California halibut	0.102	0.000	0.000	0.000	0.235	0.000	7.254	7.254	7.345	0.000	0.500	0.000	22.690
chub mackerel	0.000	1.512	0.000	1.231	18.529	0.000	0.000	0.000	0.000	0.000	0.596	0.000	21.868
spotfin croaker	0.013	0.000	0.000	0.000	4.700	8.800	0.000	8.250	0.000	0.000	0.000	0.000	21.763
barred sand bass	2.490	0.000	0.000	0.330	4.151	0.233	0.000	1.507	2.209	0.000	4.758	0.000	15.678
shiner perch	0.029	0.000	0.434	1.404	5.588	0.384	1.550	4.530	1.510	0.000	0.023	0.000	15.452
white croaker	0.776	0.112	0.124	0.158	3.553	0.000	1.178	2.083	1.671	1.736	1.877	0.066	13.333
kelp pipefish	0.760	1.666	2.852	0.303	0.322	0.300	0.000	0.000	0.000	0.744	0.724	0.028	7.699
black croaker	0.354	0.000	0.000	0.600	0.206	0.684	0.000	1.610	1.438	0.000	2.478	0.000	7.370
horn shark	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.850	0.000	0.000	4.800	0.000	6.650
walleye surfperch	0.065	0.000	0.000	0.316	0.221	0.000	1.581	2.329	1.583	0.000	0.061	0.000	6.156
thornback	5.131	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5.131
Pacific pompano	0.775	0.000	0.000	0.000	0.173	0.253	0.000	0.333	0.077	1.302	1.317	0.049	4.279
white seaperch	0.000	0.000	0.000	0.170	1.643	1.184	0.155	0.335	0.176	0.000	0.000	0.000	3.663
rockpool blenny	0.410	0.056	0.000	0.895	0.773	0.321	0.000	0.001	0.109	0.279	0.697	0.011	3.551
slough anchovy	0.000	2.268	1.023	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3.291
black perch	0.300	0.000	0.000	0.658	0.869	0.120	0.000	0.832	0.031	0.000	0.000	0.000	2.810
giant kelpfish	0.004	0.672	0.000	0.544	0.594	0.510	0.000	0.110	0.002	0.000	0.001	0.000	2.437
kelpbass	0.000	0.000	0.000	0.000	0.796	0.537	0.000	0.838	0.085	0.000	0.034	0.000	2.290
round stingray	0.000	0.000	0.000	0.740	0.291	0.690	0.000	0.000	0.000	0.000	0.354	0.000	2.075
white seabass	0.000	0.000	0.000	0.000	0.000	0.000	0.589	0.611	0.570	0.000	0.241	0.000	2.011
zebra perch	0.000	0.000	0.000	0.000	0.000	1.856	0.000	0.000	0.000	0.000	0.000	0.000	1.856
rock wrasse	0.050	0.000	0.000	0.000	0.012	0.252	0.000	0.523	0.939	0.000	0.000	0.000	1.776
Pacific barracuda	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.713	0.902	0.027	1.642
opaleye	0.000	0.000	0.000	0.000	0.000	1.281	0.000	0.000	0.000	0.000	0.000	0.000	1.281
cabezon	0.716	0.042	0.000	0.237	0.201	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.196
spotted kelpfish	0.977	0.000	0.000	0.000	0.037	0.052	0.000	0.099	0.023	0.000	0.000	0.000	1.188
blacksmith	0.112	0.000	0.000	0.000	0.139	0.000	0.000	0.205	0.173	0.000	0.555	0.000	1.184
brown rockfish	0.249	0.000	0.000	0.270	0.555	0.000	0.000	0.010	0.000	0.000	0.000	0.000	1.084
speckled sanddab	0.248	0.000	0.031	0.000	0.021	0.000	0.217	0.217	0.210	0.000	0.000	0.000	0.944

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Common Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	
Pacific staghorn sculpin	0.868	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.029	0.000	0.000	0.042	0.000	0.939
California moray	0.000	0.000	0.000	0.000	0.000	0.918	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.918
bat ray	0.000	0.000	0.000	0.000	0.251	0.000	0.000	0.399	0.000	0.000	0.000	0.000	0.000	0.650
plainfin midshipman	0.017	0.000	0.000	0.200	0.331	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.548
California grunion	0.000	0.000	0.000	0.000	0.471	0.022	0.000	0.000	0.017	0.000	0.028	0.000	0.000	0.538
grass rockfish	0.000	0.000	0.000	0.256	0.280	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.536
halfmoon	0.098	0.000	0.000	0.000	0.000	0.000	0.000	0.386	0.000	0.000	0.000	0.000	0.000	0.484
bocaccio	0.000	0.056	0.000	0.090	0.093	0.090	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.329
senorita	0.000	0.000	0.000	0.000	0.008	0.000	0.000	0.026	0.019	0.000	0.082	0.000	0.000	0.135
garibaldi	0.000	0.000	0.000	0.000	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.125
treefish	0.096	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.096
barcheek pipefish	0.000	0.000	0.000	0.030	0.031	0.030	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.091
basketweave cusk-eel	0.000	0.000	0.000	0.008	0.026	0.000	0.000	0.000	0.012	0.000	0.017	0.000	0.000	0.063
California corbina	0.000	0.000	0.000	0.062	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.062
crevice kelpfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.061	0.000	0.000	0.061
spotted turbot	0.000	0.000	0.000	0.018	0.000	0.000	0.000	0.000	0.000	0.000	0.040	0.000	0.000	0.058
striped kelpfish	0.051	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.053
spotted cusk-eel	0.000	0.000	0.000	0.000	0.048	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.048
dwarf perch	0.000	0.000	0.000	0.038	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.038
kelp perch	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.020	0.000	0.000	0.000	0.000	0.000	0.020
California lizardfish	0.000	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.014
vermillion rockfish	0.000	0.000	0.000	0.005	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.011
spotted sand bass	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
California tonguefish	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
pipefish, unid.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.001
	238.127	251.244	70.091	839.897	961.096	788.338	222.611	1934.852	250.455	289.757	317.963	10.993	6175.42461	

APPENDIX D.

**Estimated Monthly Number of Fish Impinged
at SONGS Unit 3 in 2007.**

Appendix D. Estimated Monthly Number of Fish at SONGS Unit 3 in 2007

Common Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
queenfish	2544	22050	4541	32614	16322	16451	19312	29222	17885	24574	24069	24459	234043
northern anchovy	668	3486	589	2477	2139	2078	101	279	682	4221	4654	4464	25837
Pacific sardine	38	14	313	232	4015	3887	113	97	90	0	5	0	8804
salema	106	126	810	617	16	36	627	742	98	388	798	372	4735
kelp pipefish	239	518	1630	825	171	167	0	0	0	88	90	93	3821
deepbody anchovy	1015	602	2	30	0	0	0	4	6	442	504	465	3069
slough anchovy	2004	280	0	0	0	0	0	0	0	0	0	0	2284
plainfin midshipman	0	0	124	1231	341	330	0	0	0	0	0	0	2026
yellowfin croaker	2	0	1	1	0	0	1111	700	4	17	62	0	1898
jacksmelt	44	56	94	460	465	569	10	0	0	0	7	0	1705
Pacific pompano	48	0	0	1	450	437	11	0	0	31	52	31	1061
topsmelt	183	0	88	1	0	10	186	222	46	91	110	93	1029
rockpool blenny	68	0	435	304	16	55	39	55	33	3	7	0	1014
jack mackerel	1	0	0	15	78	211	80	282	3	32	171	31	904
walleye surfperch	8	0	7	19	0	5	289	270	244	0	6	0	848
sargo	0	0	0	1	0	0	78	662	4	19	32	0	796
shiner perch	2	0	4	52	140	212	258	71	31	0	0	0	770
Pacific chub mackerel	0	0	100	86	248	284	1	0	0	0	9	0	728
white croaker	32	70	45	73	93	105	79	60	37	32	40	31	697
California scorpionfish	59	28	65	220	62	60	40	33	30	32	34	31	694
giant kelpfish	34	28	16	183	78	76	5	0	2	59	65	62	608
California grunion	0	14	0	1	264	297	2	0	1	1	1	0	581
black perch	2	0	0	92	62	69	6	2	0	0	0	0	233
white seaperch	0	0	16	1	93	91	18	10	2	0	2	0	233
cabezon	0	28	11	143	0	23	3	0	0	0	0	0	208
barred sand bass	31	0	1	17	0	0	12	22	6	19	76	0	184
roughcheek sculpin	177	0	1	0	0	0	0	0	0	0	0	0	178
rock wrasse	127	0	0	0	0	1	4	25	0	2	2	0	161
kelp bass	23	56	17	0	0	1	0	1	8	5	5	0	115
specklefin midshipman	0	0	31	15	31	31	1	0	0	0	0	0	109
California halibut	4	0	0	2	0	0	31	31	30	0	3	0	101
California butterfly ray	0	0	0	0	0	0	32	31	30	0	0	0	93
California lizardfish	0	0	62	0	16	15	0	0	0	0	0	0	93
Pacific staghorn sculpin	17	0	0	0	31	31	1	0	0	0	0	0	80
Pacific electric ray	17	14	0	15	16	15	0	0	0	0	0	0	76
bocaccio	0	0	0	75	0	0	0	0	0	0	0	0	75
spotted turbot	22	0	1	45	0	0	1	1	0	0	1	0	71
spotfin croaker	0	0	16	0	0	1	10	27	0	0	12	0	66
barcheek pipefish	0	0	0	2	31	30	0	0	0	0	0	0	63
mussel blenny	17	14	31	0	0	0	0	0	0	0	0	0	62
basketweave cusk-eel	0	0	0	49	0	2	5	0	0	0	0	0	56
zebra perch	0	0	0	0	0	0	0	55	0	0	0	0	55
Pacific barracuda	1	0	31	0	0	0	0	0	0	0	15	0	47
bat ray	0	14	1	0	16	15	0	0	0	0	0	0	46
senorita	0	42	0	0	0	0	0	0	0	0	0	0	42
speckled sanddab	1	0	20	17	0	0	1	0	0	0	0	0	39

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Common Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Cortez bonefish	0	0	0	0	16	15	0	0	0	0	0	0	31
grey smoothhound	0	0	0	0	16	15	0	0	0	0	0	0	31
spotted kelpfish	13	0	0	15	0	0	0	0	0	0	0	0	28
bay pipefish	0	14	0	13	0	0	0	0	0	0	0	0	27
white seabass	1	0	0	0	0	0	4	9	1	2	4	0	21
black croaker	2	0	3	1	0	0	5	4	0	1	2	0	18
striped kelpfish	0	0	0	0	0	0	7	7	4	0	0	0	18
snubnose sculpin	17	0	0	0	0	0	0	0	0	0	0	0	17
coralline sculpin	0	0	16	0	0	0	0	0	0	0	0	0	16
blacksmith	6	0	0	0	0	1	1	1	0	3	3	0	15
yellow snake eel	0	0	0	15	0	0	0	0	0	0	0	0	15
California sheephead	0	0	0	0	0	14	0	0	0	0	0	0	14
brown rockfish	2	0	1	5	0	1	0	0	0	0	0	0	9
rubberlip seaperch	4	0	0	0	0	0	3	2	0	0	0	0	9
crevice kelpfish	0	0	0	0	0	0	0	0	0	0	7	0	7
kelp perch	0	0	0	0	0	0	1	4	0	0	0	0	5
pipefish, unid.	5	0	0	0	0	0	0	0	0	0	0	0	5
California corbina	0	0	0	0	0	0	2	1	0	0	1	0	4
bay goby	1	0	0	0	0	0	0	1	0	0	0	0	2
California tonguefish	0	0	2	0	0	0	0	0	0	0	0	0	2
pile perch	0	0	0	0	0	0	0	2	0	0	0	0	2
vermillion rockfish	0	0	0	2	0	0	0	0	0	0	0	0	2
garibaldi	0	0	1	0	0	0	0	0	0	0	0	0	1
Gibbonsia kelpfish, unid.	0	0	1	0	0	0	0	0	0	0	0	0	1
leopard shark	0	0	0	0	0	0	1	0	0	0	0	0	1
stripedfin ronquil	0	0	0	0	0	0	1	0	0	0	0	0	1
	7585	27454	9123	39967	25219	25641	22492	32935	19277	30062	30849	30132	300736

APPENDIX E.

**Estimated Monthly Catch in Kilograms of Fish
at SONGS Unit 3 in 2007.**

Appendix E. Estimated Monthly Catch in Kilograms at SONGS Unit 3 in 2007

Common Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
queenfish	11.763	127.470	30.600	311.550	410.177	410.684	174.086	263.048	149.798	77.473	78.980	75.516	2121.144
Pacific electric ray	87.917	122.500	0.000	117.000	173.600	168.000	0.000	0.000	0.000	0.000	0.000	0.000	669.017
yellowfin croaker	0.292	0.000	0.011	0.292	0.000	0.000	291.420	212.775	0.908	3.987	9.550	0.000	519.235
Pacific sardine	0.893	0.574	12.069	9.067	175.863	170.285	4.560	4.237	3.900	0.000	0.156	0.000	381.604
sargo	0.000	0.000	0.000	0.009	0.000	0.000	16.280	177.385	0.914	3.689	1.700	0.000	199.977
California halibut	0.184	0.000	0.000	0.514	0.000	0.000	46.500	46.500	45.000	0.000	0.284	0.000	138.982
jacksmelt	2.251	5.236	6.608	34.591	35.666	41.452	0.570	0.000	0.000	0.000	0.602	0.000	126.975
salema	0.537	1.064	6.197	6.700	0.155	0.832	26.241	32.368	3.470	2.434	15.930	1.271	97.198
mussel blenny	0.050	0.070	0.078	0.000	0.000	0.000	0.000	0.000	0.000	23.684	24.300	25.110	73.292
Pacific chub mackerel	0.000	0.000	6.910	7.918	20.274	24.093	0.146	0.000	0.000	0.000	1.500	0.000	60.841
plainfin midshipman	0.000	0.000	3.875	36.831	8.494	8.220	0.000	0.000	0.000	0.000	0.000	0.000	57.420
jack mackerel	0.013	0.000	0.000	1.860	4.449	12.497	5.250	24.050	0.100	0.667	4.896	0.620	54.401
northern anchovy	0.716	5.320	1.034	2.658	14.958	14.576	0.154	0.340	2.169	0.018	1.326	0.000	43.268
Pacific pompano	0.581	0.000	0.000	0.025	16.167	15.728	0.408	0.000	0.000	0.945	1.650	0.930	36.434
topsmelt	1.945	0.000	3.436	0.048	0.000	0.370	8.591	11.347	2.515	2.385	3.040	2.418	36.095
zebra perch	0.000	0.000	0.000	0.000	0.000	0.000	0.000	33.050	0.000	0.000	0.000	0.000	33.050
California scorpionfish	3.855	1.008	2.048	10.504	0.605	0.585	0.453	0.360	0.270	1.086	2.290	0.868	23.931
barred sand bass	3.620	0.000	0.011	2.948	0.000	0.000	2.620	3.370	0.486	0.163	8.460	0.000	21.678
California butterfly ray	0.000	0.000	0.000	0.000	0.000	0.000	8.389	6.169	5.970	0.000	0.000	0.000	20.528
spotfin croaker	0.000	0.000	1.411	0.000	0.000	0.562	3.800	11.731	0.000	0.000	2.700	0.000	20.204
deepbody anchovy	6.421	5.320	0.024	0.225	0.000	0.000	0.000	0.080	0.036	2.201	2.720	2.294	19.321
white croaker	0.540	0.252	0.706	0.269	3.410	4.120	0.451	0.624	0.460	2.085	2.374	2.170	17.461
grey smoothhound	0.000	0.000	0.000	0.000	8.789	8.505	0.000	0.000	0.000	0.000	0.000	0.000	17.294
walleye surfperch	0.206	0.000	0.215	0.327	0.000	0.273	4.029	3.834	3.685	0.000	0.162	0.000	12.731
bat ray	0.000	3.934	0.333	0.000	4.030	3.900	0.000	0.000	0.000	0.000	0.000	0.000	12.197
California grunion	0.000	0.070	0.000	0.018	5.642	6.354	0.050	0.000	0.005	0.003	0.028	0.000	12.170
giant kelpfish	0.759	0.168	0.202	3.745	1.597	1.592	0.134	0.000	0.083	0.344	0.372	0.341	9.335
shiner perch	0.022	0.000	0.073	1.017	1.643	3.645	2.213	0.588	0.099	0.000	0.000	0.000	9.300
chub mackerel	0.000	0.000	0.648	0.898	0.000	4.473	0.146	0.000	0.000	0.000	1.500	0.000	7.665
kelp pipefish	0.440	0.938	2.763	1.050	0.295	0.289	0.000	0.000	0.000	0.234	0.240	0.248	6.497
slough anchovy	5.012	0.672	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5.684
rock wrasse	0.258	0.000	0.000	0.000	0.000	0.206	0.290	3.812	0.000	0.201	0.110	0.000	4.877
rockpool blenny	0.220	0.000	1.572	1.206	0.047	0.175	0.409	0.407	0.375	0.007	0.028	0.000	4.445
spotted turbot	0.180	0.000	0.014	3.105	0.000	0.000	0.010	0.009	0.000	0.000	0.008	0.000	3.326
white seabass	0.068	0.000	0.000	0.000	0.000	0.000	1.269	0.766	0.474	0.147	0.324	0.000	3.048
Pacific barracuda	0.005	0.000	2.604	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.426	0.000	3.035
black croaker	0.046	0.000	0.248	0.116	0.000	0.000	0.667	0.632	0.000	0.005	0.194	0.000	1.908
specklefin midshipman	0.000	0.000	0.326	0.090	0.388	1.073	0.008	0.000	0.000	0.000	0.000	0.000	1.884
black perch	0.069	0.000	0.000	0.702	0.279	0.626	0.120	0.072	0.000	0.000	0.000	0.000	1.868
white seaperch	0.000	0.000	0.574	0.019	0.264	0.309	0.203	0.124	0.019	0.000	0.146	0.000	1.657
Pacific staghorn sculpin	0.854	0.000	0.000	0.000	0.357	0.359	0.018	0.000	0.000	0.000	0.000	0.000	1.588
cabezon	0.000	0.056	0.042	0.959	0.000	0.260	0.070	0.000	0.000	0.000	0.000	0.000	1.387
roughcheek sculpin	1.147	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.152
brown rockfish	0.081	0.000	0.053	0.680	0.000	0.219	0.000	0.000	0.000	0.000	0.000	0.000	1.033
kelp bass	0.093	0.252	0.123	0.000	0.000	0.157	0.000	0.144	0.165	0.014	0.078	0.000	1.026
California corbina	0.000	0.000	0.000	0.000	0.000	0.000	0.245	0.629	0.000	0.000	0.020	0.000	0.894
blacksmith	0.072	0.000	0.000	0.000	0.000	0.055	0.042	0.073	0.000	0.090	0.152	0.000	0.484

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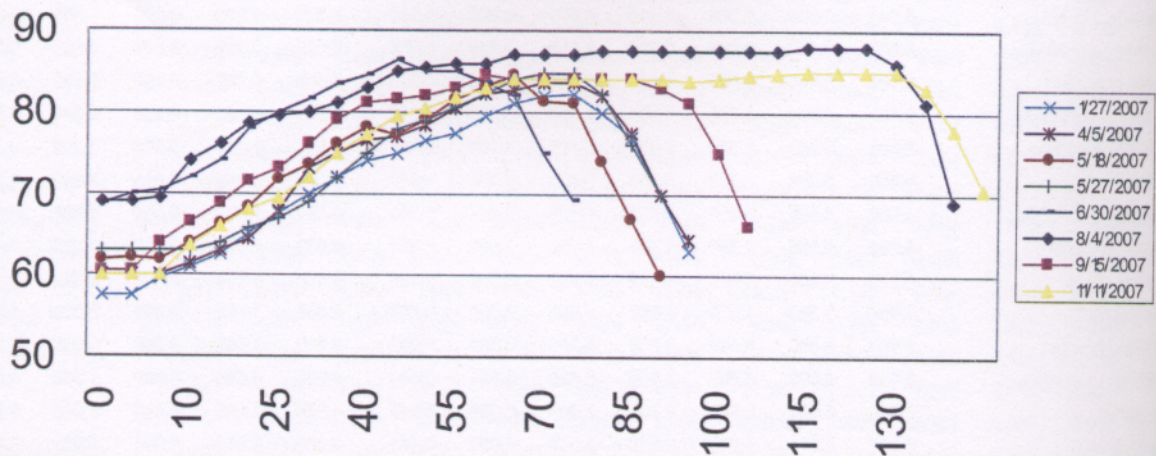
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Common Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
basketweave cusk-eel	0.000	0.000	0.000	0.416	0.000	0.017	0.040	0.000	0.000	0.000	0.000	0.000	0.473
California lizardfish	0.000	0.000	0.062	0.000	0.186	0.180	0.000	0.000	0.000	0.000	0.000	0.000	0.428
yellow snake eel	0.000	0.000	0.000	0.315	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.315
speckled sanddab	0.001	0.000	0.206	0.077	0.000	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.292
spotted kelpfish	0.104	0.000	0.000	0.150	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.254
rubberlip seaperch	0.103	0.000	0.000	0.000	0.000	0.000	0.055	0.082	0.000	0.000	0.000	0.000	0.240
barcheek pipefish	0.000	0.000	0.000	0.003	0.109	0.105	0.000	0.000	0.000	0.000	0.000	0.000	0.217
bocaccio	0.000	0.000	0.000	0.195	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.195
senorita	0.000	0.168	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.168
striped kelpfish	0.000	0.000	0.000	0.000	0.000	0.000	0.081	0.039	0.002	0.000	0.000	0.000	0.122
leopard shark	0.000	0.000	0.000	0.000	0.000	0.000	0.100	0.000	0.000	0.000	0.000	0.000	0.100
kelp perch	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.063	0.000	0.000	0.000	0.000	0.075
coralline sculpin	0.000	0.000	0.062	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.062
California sheephead	0.000	0.000	0.000	0.000	0.000	0.061	0.000	0.000	0.000	0.000	0.000	0.000	0.061
pile perch	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.054	0.000	0.000	0.000	0.000	0.054
bay pipefish	0.000	0.014	0.000	0.018	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.032
Cortez bonefish	0.000	0.000	0.000	0.000	0.016	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.031
snubnose sculpin	0.017	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.017
crevice kelpfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.000	0.010
vermillion rockfish	0.000	0.000	0.000	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.010
garibaldi	0.000	0.000	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009
Gibbonsia kelpfish, unid.	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006
pipefish, unid.	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004
California tonguefish	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
stripedfin ronquil	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.003
bay goby	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.002
	131.340	275.086	85.156	558.125	887.453	904.852	600.141	838.763	220.903	121.860	166.256	111.786	4,901.721

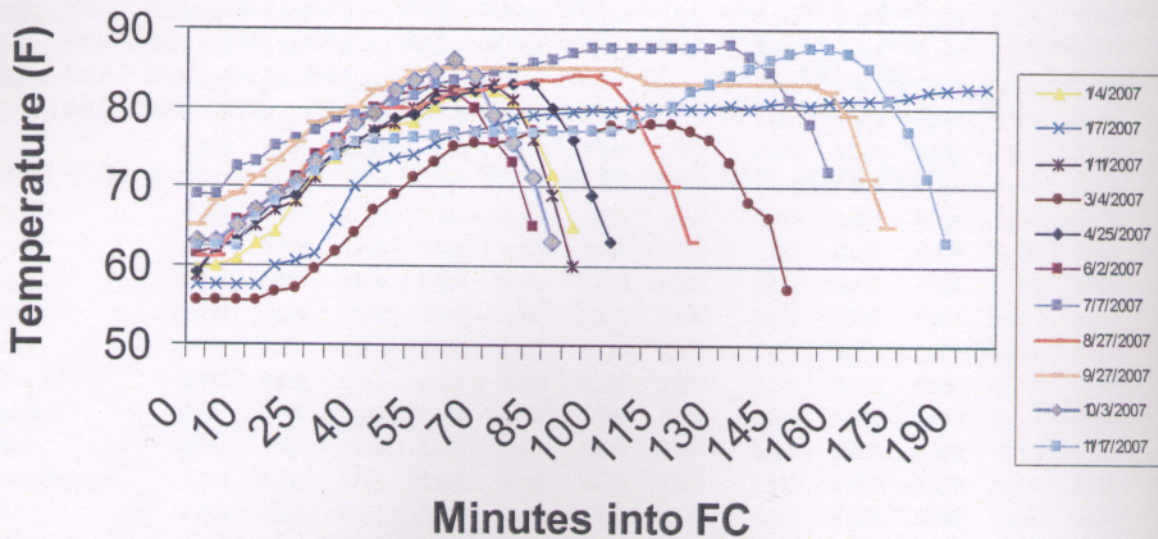
APPENDIX F.

Graphs Of Temperature Curves for Fish Chases At SONGS Units 2 and 3 in 2007

Unit 2 Fish Chase Temperature



Unit 3 Fish Chase Temperature



APPENDIX G.

Summary of Fish Released During Fish Chase Operations (By Species)

Appendix G. Summary of Fish Released During Fish Chase Operations (By Species) in 2007.

Common Name	Unit 2 Fish Chase		Unit 3 Fish Chase		Unit 2 Heat treat		Unit 3 Heat treat		% Returned by Count	% Returned by Biomass
	Number	Kgs	Number	Kgs	Number	Kgs	Number	Kgs		
shovelnose guitarfish	1	4							100.00%	100.00%
barred surfperch	1	0.18			1	0.15			100.00%	100.00%
Hypsoblennius blenny, unicolor	3	0.01			11	0.04			100.00%	100.00%
bat ray	4	33	2	0.65	1	5	1	0.333	62.50%	97.48%
spotfin croaker	674	228.26	62	21.75	3221	1309	50	18.79	97.20%	97.43%
garibaldi	7	1.4	1	0.125	4	0.51	1	0.009	84.62%	93.44%
pile perch					1	0.75	2	0.054	33.33%	93.28%
California electric ray	5	75	1	11.25	2	45			87.50%	91.43%
zebra perch	78	45.41	3	1.856	478	287.5	55	33.05	90.55%	90.51%
Pacific sardine	7	0.264	77	2.173	1219	33.81	46	1.548	90.88%	90.16%
chub mackerel	965	101.34	202	20.356	250	27.92	7	0.01	85.32%	86.39%
northern anchovy	3645	9.286	1216	3.872	16536	33.63	1319	4.198	88.84%	84.17%
kelpbass	25	4.222	18	2.29	38	5.446	27	0.615	58.33%	76.89%
California moray	1	1.2	1	0.918	1	2	14	0.061	11.76%	76.57%
California corbina	9	1.75	1	0.062	7	1.27	4	0.894	76.19%	75.96%
halfmoon	4	0.81	2	0.484	3	0.66			77.78%	75.23%
giant seabass	3	101.25	1	65	3	84			85.71%	74.03%
yellowfin croaker	9017	3308.2	4087	1490.32	4161	1868	1898	519.2	68.77%	72.03%
barred sand bass	244	39.002	104	15.383	287	45.26	169	18.9	66.04%	71.08%
salema	9059	333.19	4961	131.284	4329	176.1	2970	79.86	62.80%	70.69%
rubberlip seaperch	1	0.4					6	0.19	14.29%	67.80%
leopard shark	1	0.2					1	0.1	50.00%	66.67%
California scorpionfish	38	2.862	107	6.685	86	10.48	2	0.003	53.22%	66.62%
horn shark	1	5.5	2	6.65	3	6.2			66.67%	63.76%
jack mackerel	871	50.077	468	23.456	932	53.88	646	41.98	61.81%	61.37%
round stingray	4	1.2	5	2.075	6	1.8			66.67%	59.11%
blacksmith	19	1.166	30	1.184	13	0.5	15	0.484	41.56%	49.97%
senorita	1	0.02	12	0.135	2	0.13	6	0.018	14.29%	49.50%
sargo	322	50.46	1028	191.932	1188	332.4	800	200.1	45.24%	49.41%
specklefin midshipman	5	0.472	11	0.73	3	0.9	2	0.706	38.10%	48.86%
jacksmelt	66	4.44	219	16.96	610	35.65	417	29.25	51.52%	46.45%
vermillion rockfish			3	0.011	3	0.017	2	0.01	37.50%	44.74%
grass rockfish			2	0.536	1	0.43			33.33%	44.51%
opaleye			1	1.281	2	1			66.67%	43.84%
giant kelpfish	4	0.068	12	0.212	14	0.329	18	0.448	37.50%	37.56%
black perch	12	1.56	28	2.446	4	0.35	21	0.944	24.62%	36.04%
brown rockfish	2	0.103	11	1.084	5	0.893	9	1.033	25.93%	31.99%
cabezon	2	0.65	56	1.154	6	0.11	75	0.761	5.76%	28.41%
white seaperch	10	0.736	47	3.208	9	0.67	34	0.565	19.00%	27.15%

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Common Name	Unit 2 Fish Chase		Unit 3 Fish Chase		Unit 2 Heat treat		Unit 3 Heat treat		% Returned by Count	% Returned by Biomass
	Number	Kgs	Number	Kgs	Number	Kgs	Number	Kgs		
black croaker	18	2.25	57	7.37	9	0.751	18	1.908	26.47%	24.44%
white seabass	1	0.1	4	0.263	8	0.95	21	3.048	26.47%	24.08%
Pacific staghorn sculpin			2	0.071	1	0.03	2	0.032	20.00%	22.56%
queenfish	3151	41.244	5822	98.493	3503	36.28	15594	168	23.71%	22.54%
white croaker	53	2.302	206	5.484	3	0.053	171	2.864	12.93%	22.00%
rock wrasse	9	1.09	16	1.776	4	0.371	34	4.619	20.63%	18.60%
walleye surfperch	11	0.46	72	1.464	9	0.396	97	2.538	10.58%	17.62%
Pacific pompano	3	0.126	18	0.893	14	0.37	53	1.597	19.32%	16.61%
California grunion	24	0.2	27	0.539	4	0.085	48	0.998	27.18%	15.64%
California halibut	3	0.3	8	1.162	1	0.03	9	0.982	19.05%	13.34%
basketweave cusk-eel	2	0.02	12	0.063			11	0.068	8.00%	13.25%
plainfin midshipman			20	0.531	1	0.085	1	0.081	4.55%	12.20%
Pacific barracuda	1	0.02	10	0.212	1	0.05	16	0.431	7.14%	9.82%
kelp pipefish			8	0.019	3	0.01	56	0.075	4.48%	9.62%
deep body anchovy	6	0.07	166	2.045	20	0.11			13.54%	8.09%
topsmelt	42	1.58	142	5.476	9	0.503	485	20.84	7.52%	7.33%
California lizardfish	1	0.08					73	5.375	1.35%	1.47%
rockpool blenny			722	1.946	16	0.046	601	2.057	1.19%	1.14%
spotted kelpfish			20	0.211	1	0.003	13	0.104	2.94%	0.94%
shiner perch			482	9.326	3	0.08	358	4.981	0.36%	0.56%
California tonguefish			1	0.001			72	7.665	0.00%	0.00%
California butterfly ray							1	2.22	0.00%	0.00%
crevice kelpfish			22	0.061			213	1.94	0.00%	0.00%
spotted turbot			4	0.058			9	0.137	0.00%	0.00%
striped kelpfish			5	0.053			18	0.122	0.00%	0.00%
treefish			1	0.096					0.00%	0.00%
kelp perch			2	0.02			5	0.075	0.00%	0.00%
slough anchovy							28	0.072	0.00%	0.00%
spotted cusk-eel			1	0.048					0.00%	0.00%
dwarf perch			1	0.038					0.00%	0.00%
speckled sanddab			6	0.021			8	0.016	0.00%	0.00%
pipefish, unid.			7	0.018			5	0.004	0.00%	0.00%
bay pipefish							13	0.018	0.00%	0.00%
spotfin surfperch			1	0					0.00%	0.00%
Gibbonsia kelpfish, unid.							1	0.006	0.00%	0.00%
roughcheek sculpin							1	0.005	0.00%	0.00%
barcheek pipefish							2	0.003	0.00%	0.00%
spotted sand bass			1	0.003					0.00%	0.00%
stripedfin ronquil							1	0.0	0.00%	0.00%
bay goby							2	0.0	0.00%	0.00%
	28436	4457.507	20647	2165.29	37050	4411.3	26657	1187	58.06%	72.57%

APPENDIX H.

Species of Special Interest Impinged or Entrained During 2007

Many researchers and resource managers have found impingement data to be a valuable tool in providing data on the dynamics of marine organisms in near-shore coastal waters. Though not a required part of this marine environmental monitoring report, the following information is provided for those who may be interested in these species:

Appendix H. Species of Special Interest Impinged in 2007.

Species	Reason for concern	Heat Treatment	Normal Operation	Fish Chase
Fish				
California halibut	Important sport and commercial fish	8	1	4
Cabazon	Species of special concern	56	2	8
Bocaccio	Species of special concern	0	2	0
Giant seabass	Protected in California	1	0	6
Kelp bass	Important recreational fish	8	0	63
White seabass	Important sport and commercial fish	4	1	9

Species	Reason for concern	Returned Alive	Found Dead
Mammals and Turtles			
California sea lion	Marine Mammal Protection Act	8	33
Harbor seal	Marine Mammal Protection Act	18	10
Green Sea Turtles	Endangered Species Act	2	0

APPENDIX I.

Unit 2 Fish Return System Efficiency in 2007

Appendix I. Unit 2 Fish Return System Efficiency in 2007

Unit 2	FRS cnt	FRS kg	NO cnt	NO kg	% Return Abun	% Return Kg	Total Biomass
<i>Torpedo californica</i>	2	50.000	4	33	33.33%	60.24%	83.000
<i>Seriphus politus</i>	6274	59.118	2010	12.754	75.74%	82.25%	71.872
<i>Atherinopsis californiensis</i>	122	20.345	97	7.841	55.71%	72.18%	28.186
<i>Xenistius californiensis</i>	2181	20.557	68	0.441	96.98%	97.90%	20.998
<i>Myliobatis californica</i>	2	5.727			100.00%	100.00%	5.727
<i>Anchoa compressa</i>	314	2.949	220	1.624	58.80%	64.49%	4.573
<i>Sardinops sagax</i>	97	2.916	48	1.444	66.90%	66.88%	4.360
<i>Engraulis mordax</i>	666	2.454	359	0.558	64.98%	81.47%	3.012
<i>Hyperprosopon argenteum</i>	73	2.246			100.00%	100.00%	2.246
<i>Embiotoca jacksoni</i>	8	1.434	1	0.004	88.89%	99.72%	1.438
<i>Scorpaena guttata</i>	14	1.327			100.00%	100.00%	1.327
<i>Scomber japonicus</i>	13	1.025	1	0.108	92.86%	90.47%	1.133
<i>Cephaloscyllium ventriosum</i>			1	0.942	0.00%	0.00%	0.942
<i>Anchoa delicatissima</i>	13	0.034	294	0.849	4.23%	3.85%	0.883
<i>Atherinops affinis</i>	23	0.693	3	0.124	88.46%	84.82%	0.817
<i>Paralabrax nebulifer</i>	7	0.720			100.00%	100.00%	0.720
<i>Gymnura marmorata</i>	1	0.500			100.00%	100.00%	0.500
<i>Phanerodon furcatus</i>	6	0.423			100.00%	100.00%	0.423
<i>Scorpaena guttata</i>			10	0.397	0.00%	0.00%	0.397
<i>Platyrrhinoidis triseriata</i>			1	0.331	0.00%	0.00%	0.331
<i>Hypsypops rubicundus</i>	1	0.300			100.00%	100.00%	0.300
<i>Syngnathus californiensis</i>			151	0.27	0.00%	0.00%	0.270
<i>Anisotremus davidsonii</i>			1	0.251	0.00%	0.00%	0.251
<i>Umbrina roncadore</i>	2	0.210			100.00%	100.00%	0.210
<i>Pleuronichthys ritteri</i>	2	0.180			100.00%	100.00%	0.180
<i>Cymatogaster aggregata</i>	6	0.113	2	0.026	75.00%	81.29%	0.139
<i>Heterostichus rostratus</i>	8	0.074	7	0.065	53.33%	53.24%	0.139
<i>Genyonemus lineatus</i>	11	0.077	10	0.053	52.38%	59.23%	0.130
<i>Medialuna californiensis</i>	1	0.100			100.00%	100.00%	0.100
<i>Paralichthys californicus</i>	1	0.100			100.00%	100.00%	0.100
<i>Menticirrhus undulatus</i>	1	0.080			100.00%	100.00%	0.080
<i>Trachurus symmetricus</i>	1	0.080			100.00%	100.00%	0.080
<i>Gibbonsia elegans</i>			6	0.063	0.00%	0.00%	0.063
<i>Leptocottus armatus</i>			2	0.056	0.00%	0.00%	0.056
<i>Peprilus simillimus</i>			5	0.05	0.00%	0.00%	0.050
<i>Hypsoblennius gentilis</i>	1	0.030			100.00%	100.00%	0.030
<i>Hypsoblennius gilberti</i>			5	0.024	0.00%	0.00%	0.024
<i>Paralabrax nebulifer</i>			1	0.019	0.00%	0.00%	0.019
<i>Citharichthys stigmaeus</i>			9	0.017	0.00%	0.00%	0.017
<i>Sebastes paucispinis</i>			2	0.007	0.00%	0.00%	0.007
<i>Porichthys myriaster</i>			1	0.004	0.00%	0.00%	0.004
<i>Scorpaenichthys marmoratus</i>			2	0.003	0.00%	0.00%	0.003
<i>Oxyjulis californica</i>			2	0.002	0.00%	0.00%	0.002
<i>Syngnathus exilis</i>			2	0.001	0.00%	0.00%	0.001
<i>Synodus lucioceps</i>			1	0.001	0.00%	0.00%	0.001
Total	9871	173.815	3326	69.006	74.80%	71.58%	242.821

APPENDIX J.

Unit 3 Fish Return System Efficiency in 2007

Appendix J. Unit 3 Fish Return Efficiency in 2007

Species	FRS cnt	FRS kg	NO cnt	NO kg	% Return Count	% Return Kg	Total Biomass
<i>Seriphus politus</i>	7028	96.639	5173	58.305	57.60%	62.37%	154.944
<i>Atherinopsis californiensis</i>	935	82.227	55	4.153	94.44%	95.19%	86.380
<i>Torpedo californica</i>	4	45.000	4	33.000	50.00%	57.69%	78.000
<i>Sardinops sagax</i>	154	6.187	297	12.787	34.15%	32.61%	18.974
<i>Gymnura marmorata</i>	2	15.700			100.00%	100.00%	15.700
<i>Xenistius californiensis</i>	1066	10.358	37	0.292	96.65%	97.26%	10.650
<i>Triakis semifasciata</i>	1	10.000			100.00%	100.00%	10.000
<i>Scomber japonicus</i>	76	6.787	27	2.180	73.79%	75.69%	8.967
<i>Roncador stearnsii</i>	15	6.304	1	0.091	93.75%	98.58%	6.395
<i>Engraulis mordax</i>	964	2.760	619	1.609	60.90%	63.17%	4.369
<i>Porichthys notatus</i>			112	3.248	0.00%	0.00%	3.248
<i>Genyonemus lineatus</i>	49	2.583	17	0.282	74.24%	90.16%	2.865
<i>Hyperprosopon argenteum</i>	89	2.373	1	0.011	98.89%	99.54%	2.384
<i>Myliobatis californica</i>	3	1.200	2	0.541	60.00%	68.93%	1.741
<i>Anchoa compressa</i>	117	0.917	97	0.703	54.67%	56.60%	1.620
<i>Scorpaena guttata</i>	7	0.440	25	0.965	21.88%	31.32%	1.405
<i>Peprilus simillimus</i>	3	0.074	31	1.062	8.82%	6.51%	1.136
<i>Phanerodon furcatus</i>	12	1.040	7	0.054	63.16%	95.06%	1.094
<i>Menticirrhus undulatus</i>	8	1.040			100.00%	100.00%	1.040
<i>Trachurus symmetricus</i>	13	0.588	6	0.411	68.42%	58.86%	0.999
<i>Heterostichus rostratus</i>	7	0.160	22	0.415	24.14%	27.83%	0.575
<i>Mustelus californicus</i>			1	0.567	0.00%	0.00%	0.567
<i>Atherinops affinis</i>	17	0.367	11	0.162	60.71%	69.38%	0.529
<i>Leuresthes tenuis</i>	3	0.070	18	0.369	14.29%	15.95%	0.439
<i>Cymatogaster aggregata</i>	8	0.243	12	0.160	40.00%	60.30%	0.403
<i>Paralabrax nebulifer</i>	1	0.200	1	0.185	50.00%	51.95%	0.385
<i>Anchoa delicatissima</i>	13	0.037	138	0.343	8.61%	9.74%	0.380
<i>Pleuronichthys ritteri</i>	2	0.150	4	0.212	33.33%	41.44%	0.362
<i>Syngnathus californiensis</i>			219	0.356	0.00%	0.00%	0.356
<i>Paralabrax clathratus</i>	2	0.250	6	0.028	25.00%	89.93%	0.278
<i>Embiotoca jacksoni</i>	3	0.230	10	0.043	23.08%	84.25%	0.273
<i>Sphyræna argentea</i>	1	0.100	2	0.168	33.33%	37.31%	0.268
<i>Paralichthys californicus</i>	4	0.236			100.00%	100.00%	0.236
<i>Sebastes serriceps</i>	1	0.120			100.00%	100.00%	0.120
<i>Hypsoblennius gilberti</i>			28	0.094	0.00%	0.00%	0.094
<i>Leptocottus armatus</i>			3	0.074	0.00%	0.00%	0.074
<i>Porichthys myriaster</i>			5	0.052	0.00%	0.00%	0.052
<i>Acanthogobius flavimanus</i>	1	0.050			100.00%	100.00%	0.050
<i>Cheilotrema saturnum</i>	1	0.050			100.00%	100.00%	0.050
<i>Ophichthidae unid</i>	1	0.050			100.00%	100.00%	0.050
<i>Scorpaenichthys marmoratus</i>			9	0.042	0.00%	0.00%	0.042
<i>Ophidion scrippsae</i>	1	0.010	3	0.027	25.00%	27.03%	0.037
<i>Ophichthus zophochir</i>			1	0.021	0.00%	0.00%	0.021
<i>Porichthys sp.</i>	1	0.020			100.00%	100.00%	0.020
<i>Citharichthys stigmaeus</i>			2	0.018	0.00%	0.00%	0.018
<i>Synodus lucioceps</i>			5	0.016	0.00%	0.00%	0.016
<i>Hypsoblennius jenkinsi</i>			4	0.013	0.00%	0.00%	0.013
<i>Sebastes paucispinis</i>			5	0.013	0.00%	0.00%	0.013
<i>Oxyjulis californica</i>			3	0.012	0.00%	0.00%	0.012
<i>Gibbonsia elegans</i>			1	0.01	0	0	0.01
<i>Syngnathus exilis</i>			2	0.007	0	0	0.01
<i>Artedius corallinus</i>			1	0.004	0	0	0.00
<i>Albula sp</i>			1	0.001	0	0	0.00
<i>Orthonopias triacis</i>			1	0.001	0	0	0.00
<i>Syngnathus leptorhynchus</i>			1	0.001	0.00%	0.00%	0.001
Total	10673	294.572	7030	160.828	60.29%	64.68%	455.400